AVIATION
FOR JUNE 1933

The equipment of air forces

FRANCE (PART TWO): BOMBERS, MULTIPLACE FIGHTERS, AND NAVAL AIRCRAFT

By John Jay Ide

IN FRANCE, as in other European countries, bombing aircraft are subdivided into several groups. The heavy bomber has attracted a great deal of attention, but it has not by any means forced the lighter types from the field. As in most European practice, the light and heavy divisions differ from each other in performance as well as in size and capacity, and are commonly distinguished by the type of operation in which it is presumed that they would typically be employed—as day and night bombers, respectively. [The distinction between day and night bombardment has played relatively little part in the selection and specification of material for the American forces in the last six or eight years. In Europe, however, perhaps because of the anticipation that bombing operations will have to cross over battle-lines intensively defended by anti-aircraft artillery, impossible to traverse by day except at a very high altitude, the distinction remains very important.—Ed.]

Day bombers

Day bombing is closely allied to observation in the development of its equipment. At the end of the War, the Bréguet 14B2 was used almost exclusively. A slightly enlarged version of the Bréguet 14A2 observation ship, and having the same engine (a 300 hp. Renault), it carried 573 lb. of bombs, radio, and camera.

The armament consisted of one fixed gun for the pilot, and twin guns on a ring for the observer. It took 47 minutes to climb to 16,400 ft., and the speed at that height was 90 m.p.h.

In 1923 the Bréguet 19 (observation plane) was equipped for day bombing, and fitted generally with an engine of some 450 hp. Later, in 1926, the wing structure was strengthened to meet the new load factors which entered into force in that year. The Bréguet 19B2 has a normal bomb load of 900 lb. with a range of 300 mi. Its speed at sea level is 130 m.p.h., falling off to 124 m.p.h. at 16,400 ft., while the time of climb to 16,400 ft. is 30 minutes. These figures are for a total weight of 5,196 lb. of which 2,881 lb. is useful load.

Concurrently there was developed the Potez 25B2, likewise derived from the observation type. Although the Potez was almost entirely of wood construction, in some respects it was preferred to the Bréguet, as with the latter bomb-sighting was made somewhat difficult by the large circular section fuselage.

In 1924 a more ambitious bomber made its appearance and is still very much upon the scene. It was the S.E.C.M.—Amiot rearward staggered biplane equipped with the 650 hp. eighteen-cylinder Lorraine engine, finally put into production in 1927 under the designation "Type 122." A three-seater carrying 1,300 lb. of bombs, it has a range of 435 miles. The bomber can attend exclusively to his functions, the third member of the crew being a machine gunner for tail protection. Remarkable accuracy has been obtained with this airplane, the bomber sighting through a long trap in the fuselage floor. The S.E.C.M.—Amiot 122 has a complete metal structure, fabric-covered. Its characteristics are: wing area, 943 sq.ft.; weight equipped, 5,849 lb.; useful load, 3,031 lb.; total weight, 8,880 lb.; speed at 13,120 ft., 122 m.p.h.; climb to 13,120 ft., 27 minutes.

In 1932 examples of this airplane were built with the Lorraine "Orion" and the eighteen-cylinder Hispano-Suiza engines, developing 870 and 1,125 hp. respectively. It is probable that the machine eventually decided upon as the most desirable multiplace fighter (a category described below) will also be chosen to perform day bombing duties.

"Who walks by night"

The night bombing airplanes in service in 1920 comprised the twin-engined Farman 50 and Caudron 23 and the Bréguet 16 with a single 300-hp. Renault. The last-named carried a load of 1,212 lb. of bombs, and it managed to reach a speed of 78 m.p.h. at 13,000 ft.

In 1922 there appeared the Lioré & Olivier Le.O.7 biplane with two 300-hp. Hispano-Suiza engines, and an 11-ton Farman biplane with four 370-hp. engines and a crew of four men.

In 1923 the great armament firm Schneider, of Le Creusot, brought out to the designs of Captain Lepère (who was responsible for the famous Packard-Lepère biplane) an all-metal 11-ton biplane bomber with four engines.

In 1924, the firm of Lioré & Olivier produced the Le.O.12 biplane with two 400-hp. Lorraine engines, but this airplane was at the time overshadowed by the Farman "Goliath" having two 260-hp. engines. The Goliath was transformed into the F.63, to carry a ton of bombs, by fitting 420-hp. Gnome-Rhône Jupiters, and that version remained in service until 1930. After the Farman 63 was finally withdrawn, night bombing became the exclusive prerogative of the Lioré & Olivier Le.O.20, an all-metal ship with twin Jupiters.

The following table shows the rela-

tive characteristics of the Farman 63 and the Lioré-Olivier 20.

	F. 63	Le. O. 20
Wing area	1,722 sq.ft.	1,130 sq.ft.
Weight empty	6,393 lb.	5,688 lb.
Useful load	5,511 lb.	5,467 lb.
Total weight	11,904 lb.	11,155 lb.
Maximum speed at 10,000 ft.	100 m.p.h.	117 m.p.h.
Climb to 9,800 ft.	19.8 minutes	18.6 minutes
Ceiling	18,000 ft.	18,860 ft.
Range	500 miles	500 miles

In 1925 Farman brought out the F140, a species of super "Goliath" with four 500-hp. Farman engines. It had a total weight of 12 tons, carrying 5 tons of useful load. Only a couple of examples were built, for they proved too unwieldy.

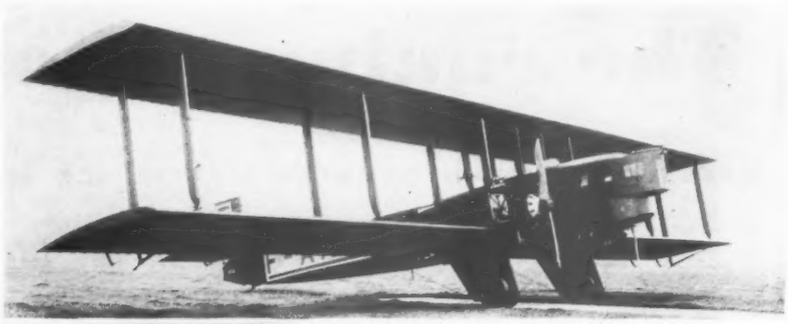
In 1929 appeared the Lioré & Olivier 25, a slightly enlarged version of the Le.O.20 with two 575-hp. Hispano-Suizas, but this was merely a transitional step to the Le.O.203, with four 350-hp. supercharged Gnome-Rhônes arranged in tandem groups. This is now the standard night bomber of the French Air Force.

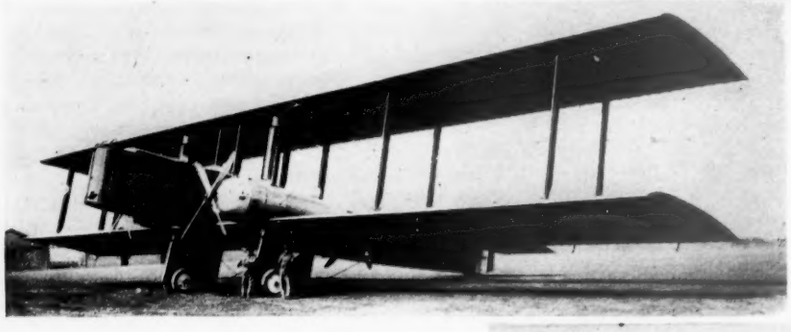
With 3,880 lb. of bombs the range of the Type 203 is 435 miles. With 2,667 lb. it can cover 680 miles. The characteristics are: wing area, 1,280 sq.ft.; weight empty, 8,025 lb.; useful load, 7,175 lb.; total weight, 15,200 lb.; speed at 11,500 ft., 124 m.p.h.; climb to 11,500 ft., 18 minutes; ceiling, 19,000 ft.

Farman's reply to the Le.O.203 is the F.212, of mixed wood and metal construction and carrying four 350-hp. Gnome-Rhône engines. This machine exists only in experimental form.

In 1926 the D.B.10 6-ton monoplane, equipped with two 420-hp. Jupiter engines, made its appearance. The center section of the wing between the engines was very deep and contained the bomb racks, the pilot and gunner being placed in the superstructure. The appearance from the front was reminiscent of the Burnelli type. Extrapolations of this design later appeared, the last being the A.B.20 with four 600-hp. Lorraine engines and having wing area, 2,217 sq.ft.; weight empty, 20,390 lb.; useful load, 10,140 lb.; total weight, 30,530 lb.

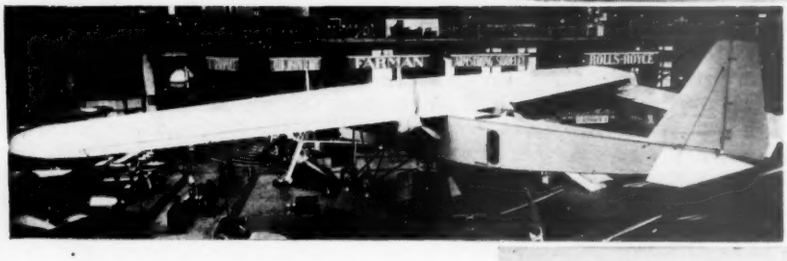
This huge machine created a very favorable impression when used in the French air maneuvers, and forms a





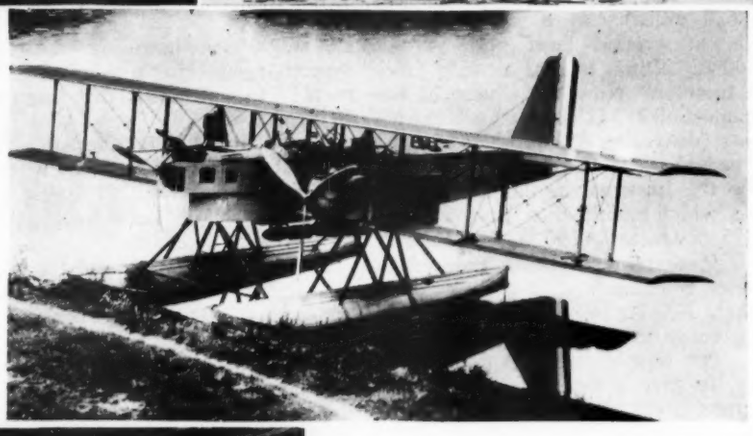
Above: The F-63 Farman night bomber was a transformed version of the "Goliath" and carried a ton of bombs. Two Gnome-Rhone "Jupiter" engines were used developing a total of 840 hp. Left: A gross weight of 12 tons, of which 5 tons were useful load was too unwieldy for 1925 and only a couple of the Super-Goliaths (Farman F-140) were built.

Right: The standard night bomber of the French Air Force, the Liore & Olivier 203, with four supercharged Gnome-Rhones (350 hp.) in tandem groups.

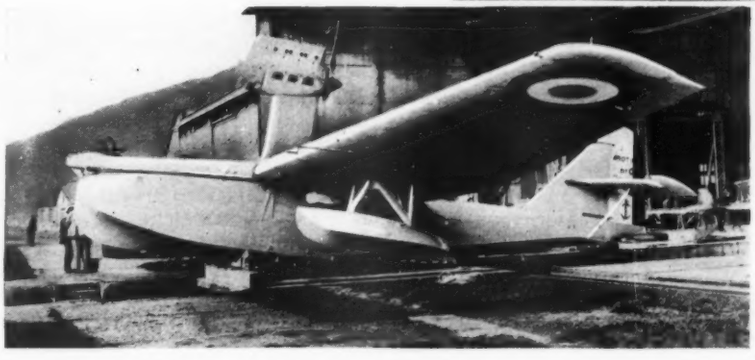


Left: The first of the huge 16½-ton night bombers (Le.0. 30) now under construction will be placed in service in 1935. Of the 7 tons of useful load, 3 are devoted to bombs.

Right: With 1,700 hp. 195 m.p.h. is promised at 14,000 ft. The S.E.C.M. 140.



Above: Forward and rear gunners are enclosed within rotating cages of glass for protection against the wind in the Breguet 41, multiplace fighter. The outrigger is of duralumin construction. Two 500-hp. Hispano-Suiza engines are mounted on the lower wings. Above right: the Levasseur P.L. 14 twin float biplane is now in service for torpedo bombing operations. Below: For coastal patrol. The Latham 110 observation monoplane flying boat with 650-hp. Hispano-Suiza engine.



Above: One of the new seaplanes. The Liore & Olivier 255 torpedo bomber, a twin float biplane with two 500-hp. Hispano-Suiza engines.

very powerful addition to the air fleet.

Huge four-engined night bombers are now approaching completion in various factories, among them the Lioré & Olivier 30 and the S.E.C.M. 180. Both are monoplanes. The former was displayed at the last Paris Salon, and with its wing spread of 125 ft. dominated the assembly. Area and heights of the Lioré & Olivier are: wing area, 2,000 sq.ft.; weight empty, 18,960 lb.; total weight, 33,100 lb.

Of the 7 tons of useful load, three will be devoted to bombs. [A recent report to the French Parliament suggests that the first of these new heavy bombers will probably be put in service about the middle of 1935.—Ed.]

Big ships for battle

The French have always attached considerable importance [more than is their lot in other countries.—Ed.] to the category of multiplace combat machines. Their primary function is the protection of day bombers, but they can serve as bombers themselves when necessary.

At the end of the War the standard multiplace fighter was the Caudron R.11 biplane, with two 220-hp. Hispano-Suizas. At the 1921 Paris Salon, there was presented the skeleton (of most complicated structure) of the four-engined Latécoère 6 biplane. In order to afford tail protection, the fuselage was placed high up between the wings. Below it was a nacelle with twin machine guns. As originally shown, the Latécoère 6 had 250-hp. Salmson engines placed in two tandem groups laterally. When finally completed, however, the power plant consisted of 400-hp. Jupiters.

Finally in 1926 appeared the Blériot 117 monoplane, subsequently equipped with 500-hp. Hispano-Suiza engines and termed the Type 127. This airplane has had a profound influence on the French air policy, and a squadron of Blériot 127's is attached to almost every day bombardment regiment in France. Curiously enough, the structure is entirely of wood, the importance of the airplane lying in its general arrangement. The engines are placed laterally in the nose of the wing, the nacelles being prolonged aft to the trailing edge where they terminate in gun cockpits low enough to permit firing forward under the wing. The fuselage has in its nose a cockpit with twin machine guns, the bomb racks being behind the pilots.

The wing area of the Blériot 127 is 950 sq.ft., the weight empty 7,150 lb. and the total weight 9,820 lb. The speed at 13,100 ft. is 137 m.p.h., and the time of climb to that height 12.3 minutes.

The question of a successor to the Blériot 127 has been under discussion for some years and four twin-engined types have been proposed: the Blériot 137, the S.P.C.A. 30, the Bréguet 41 and the S.E.C.M. 140.

The Blériot 137 is an all-metal version of the 127, with the rear gunners in sponsons projecting from the fuselage sides instead of at the rear of the engine nacelle. Two examples of this aircraft have been built. The S.P.C.A. 30 (built by the Société Provençale de Constructions Aéronautiques) is a twin-fuselage design resembling the 1924 Avimeta, but having the gunners in the fuselages half way back towards the tail instead of in the

"deckhouse" on the central portion of the wing.

The two types now receiving serious consideration are the Bréguet 41 and the S.E.C.M. 140.

Super-speed bomber-fighters

Two S.E.C.M. prototypes have been built, one with two 650-hp. Hispano-Suiza and the other with 700-hp. Lorraine engines. According to official tests, the former machine loaded as a *day bomber* (total weight 17,670 lb., including 2,200 lb. of bombs and fuel for 620 miles) has a speed of 157 m.p.h. at ground level and 143 at 14,800 ft. Climb to that altitude takes 20.5 minutes. Now the advent of the Hispano-Suiza 12Ybrs supercharged engine (delivering 850 hp. at 14,800 ft.) has caused the authorities to substitute it for the Lorraine in the second machine, which should thus have a speed of 195 m.p.h. at 14,800 ft., the time of climb to that height being reduced to fourteen minutes.

The S.E.C.M. 140 is entirely of duralumin construction, including the covering. The cantilever wings have three spars, to give great torsional rigidity. Ailerons cover the entire trailing edge of the trapezoidal wings. The engines are placed well forward of the leading edge. An interesting feature is the nacelle below the fuselage, serving as a means of protection against attacks from the rear. The wing area is 1,033 sq.ft., the weight empty 9,700 lb. and the total weight loaded as a multiplace fighter 15,000 lb.

In 1931 the Bréguet Company brought out their 41 multiplace fighter with two 500-hp. Hispano-Suiza engines. While steel is used for the wing spars, the steel girder carrying the tail of the Bréguet 27 is here replaced by a duralumin structure of somewhat larger section. The engine nacelles are placed on the lower wing, just above the landing wheels. The fuselage fills the entire gap, and the forward and rear gunners are enclosed within rotating cages of glass to protect them from the wind blast. The various posts in the fuselage are connected by a passage on the starboard side. This has necessitated the pilots being placed in tandem, the auxiliary pilot having his position aft of the bomb racks.

While with the 500-hp. engines the Type 41 has a speed of only 143 m.p.h. at 13,000 ft., installing the 650-hp. supercharged Hispano-Suizas is expected to increase this figure by 50 m.p.h.

The principal characteristics of the 41 as equipped with the new engines will be: wing area, 721 sq.ft.; weight empty, 7,360 lb.; useful load, 5,860 lb.; total weight, 13,220 lb.

In 1929 M. Caquot issued a program for airplanes to be used in the colonies and protectorates. By far the most interesting is the Nieuport 590, a high-wing monoplane with three 300-hp. Lorraine engines. The rear section of the fuselage has the cross-sectional form of a T. A covered "balcony," open at the sides. Its characteristics are: wing area, 753 sq.ft.; weight empty, 7,500 lb.; total weight, 11,100 lb.; speed, 137 m.p.h.; range, 800 miles.

The training types in service are the products of four firms: Morane-Saulnier, Hanriot, Caudron and Blériot, the machines of the first two companies being in the great majority. All Morane machines are two-seated parasol monoplanes, and typical recent examples are the Type 315 for primary training with 135 hp. and the advanced training Type 230 with 230 hp. Hanriot supplies many parasol monoplanes with 100 and 120 hp. engines, and the 437 biplane with 240 hp.

For Channel and Mediterranean

Due in part to inadequate appropriations, technical progress in naval aircraft for ten years after the War lagged behind the parallel development in land air armaments.

In 1925, however, there was held at St. Raphael an interesting two-seater marine airplane competition which brought together the Villiers C.2F and the Levasseur B.C.2 biplanes both with watertight fuselages and droppable landing gears, permitting the airplanes to alight on the water after locking the propeller in the horizontal position. Production orders were given for both.

In 1928 the Navy organized a competition for twin-engined torpedo-bombing seaplanes. The Farman 168 biplane, S.P.C.A. T3 and C.A.M.S. 60 monoplanes were entered. Each had a couple of 480-hp. Gnome-Rhone Jupiter engines. Orders were eventually placed for the Farman and C.A.M.S.

Since the advent of the Air Ministry the excessively great number of categories of naval aircraft has been reduced. The principal types in service (comprising the machines ordered between 1928 and 1931) are tabulated below.

This list does not include certain airplanes such as the well-known Wibault 7 pursuit airplane, modified for deck landing on the aircraft carrier "Béarn," and the Bréguet 19 observation airplane based on shore stations.

Among the new seaplanes, a few of which are coming into service during 1933 we can mention the Latécoère 29 twin-float torpedo monoplane (650 hp.) derived from the famous 280 mail carrier, the C.A.M.S. 90 biplane flying boat (240 hp.) and Potez 45 monoplane flying boat (230 hp.) for catapult work, the Latham 110 observation monoplane flying boat (650 hp.), which is entirely of light alloy even to the Alclad wing covering, and the Lioré-Olivier 255 torpedo-bombing twin-float biplane, with two 500-hp. supercharged Hispano-Suizas. Particularly outstanding is the Latécoère 29 torpedo carrier which has a wing area, 630 sq.ft.; weight empty, 6,300 lb.; total weight, 10,250 lb.; speed, 124 m.p.h.; range, 500 miles.

The preceding review of the history of the various types of service aircraft utilized in France since the War, while far from complete due to the exigencies of space, may give a perception of the problems with which the air authorities have had to cope. The splendid airplanes and engines now beginning to emerge are due in very great measure to the will power and tenacity of M. Caquot, the General Technical Director of the Air Ministry, in adhering to his "Program of Prototypes" and M. Laurent Eynac, the first Air Minister.

Service Aircraft

Plane and engine	Wing area (sq.ft.)	Weight empty (lb.)	Total weight (lb.)	m.p.h.	Range (miles)
Observation and bombing					
C.A.M.S. 55 biplane flying boat (two 480-hp. Gnome-Rhone Jupiters)	1,227	9,700	14,550	124	620
Latham 47 biplane flying boat (two 600-hp. Hispano-Suizas)	1,282	10,330	15,180	124	620
Torpedo bombing					
Levasseur P.L. 14 twin float biplane (600-hp. Hispano-Suiza)	802	6,173	9,237	102	310
Farman 168 twin float biplane (two 480-hp. Gnome-Rhone Jupiters)	1,722	10,141	14,991	109	...
C.A.M.S. 60 twin float monoplane (two 480-hp. Gnome-Rhone Jupiters)	1,281	9,700	15,145	120	...
Amphibions					
C.A.M.S. 37A. biplane (450-hp. Lorraine)	625	4,300	6,270	104	...
Liore-Olivier H.23 monoplane (600-hp. Hispano-Suiza)	560	5,130	7,900	120	...
Marine airplanes (for use on "Bearn" aircraft carrier).					
Levasseur 10 R.3b observation biplane (600-hp. Hispano-Suiza)	635	4,222	6,173	123	...
Levasseur 7 T.2b torpedo biplane (600-hp. Hispano-Suiza)	802	5,445	8,598	104	...
Catapult seaplane					
Gourdou-Leseurre 8113b (420-hp. Gnome-Rhone Jupiter)	441	3,682	5,423	115	...

During the past winter and the present spring, even more than in normal times, the attention of the air transport world had to be focussed upon Washington. The situation there has swung in dizzy fluctuations, and it has all been very confusing. For the benefit of our readers who haven't had the duty or the opportunity of living with air transport's governmental connections and keeping a constant watch upon them, we summarize here the most important of the developments of the last four months, and particularly those facts, conclusions, and recommendations which seem most likely to influence further legislation. Upon the course taken by the air mail, as we need hardly remind those who are in the transport business, depends the whole prospect of that business and the daily work and the livelihood of every man in it.

Investigations, legislative proposals, and the air mail

By Edward P. Warner

Editor of AVIATION

THE STUDENT of the history of American air transport progresses, as upon stepping stones, from one Kelly Bill to another. There was the Kelly Bill of 1922, which never passed, but which displayed a remarkable anticipation of problems that were to become acute eight or ten years later. There was the Kelly Bill of 1925, which was the real Magna Charta of air transportation, for its created the first contract air-mail services and, with slight amendments, it controlled the air-mail policy for five years. Now comes the Kelly Bill of 1933, a proposal to scrap the courses followed during the past three years under the Watres Act and to establish a wholly new attitude towards the air-mail service on the part of the government.

The person whose name all these measures have borne is a Republican from Western Pennsylvania. In almost twenty years as a member of the House of Representatives, he has made the postal service his most particular interest. Most of the special supporters of air transportation in Congress arrived in that category because of a special interest in aviation, with or without a war-time experience in the field. Clyde Kelly, however, got there entirely because of his interest in a better and a swifter mail service. For the airplane, as such, he cares nothing. Of the airplane as a postal carrier he has been a warm partisan.

The current Kelly Bill is the product of investigation and debate, and it cannot be intelligently discussed apart from its background. Following upon many hearings and much taking of testimony in 1930 and again a year ago this spring, the House Committee on Post Office and Post Roads settled itself last summer for a real inquiry. Devoting some eight months to the study, they presented their report on February 21. Unfortunately the report came too late to stem the tide that had swept the air mail completely out of next year's postal appropriation bill when it was first under consideration in the Senate, but it arrived in time to be of great assistance in getting the Senate to recede to such an extent that the final bill accepted by both houses of Congress at least carried $15,000,000, which is now scheduled to be available. Fifteen million dollars is not much, when the mail is being flown a hundred thousand miles a day. It is 23 per cent less than is being spent during the present fiscal year (which will end on June 30). It will allow an average payment of only 42 cents an airplane mile if operations are to continue at their present rate. Nevertheless it is a whole lot better than nothing.

As the House Committee was finishing its investigation, the Senate was laying its plans to begin. Already Senator MacKellar had reached the point, under the authorization of a Senate resolution of a year ago, of collecting a vast amount of documentary material from the Post Office Department and of having copies of all air-mail contracts and route certificates printed as a public document. On Feb. 25, four days after the House Committee under the chairmanship of Representative Mead of New York had submitted its report, the Senate had passed another resolution that called for another investigation of unprecedented and virtually untrammeled scope. A special committee of five Senators was directed by the resolution to "make a full, complete and detailed inquiry into all existing contracts entered into by the Postmaster General for the carriage of air mail, both foreign and domestic." The inquiry was specifically to determine "all the circumstances surrounding the institution and continuation of, and the necessity, if any, of maintaining, altering, or canceling such contracts"; also all the details of the financial history and present financial condition of the companies holding the contract, including a study of their income and expenditures and of the salaries that they have paid to their officers and employees and of their relationships, whether by interlocking directorates or otherwise, "with any other individual, association, public official, partnership or corporation"; also "the extent of any activities by or on behalf of any association, partnership or corporation in an effort to obtain, through legislation or otherwise, cash subsidies from the United States"; also "any other facts relating to legislation or appropriations affecting air-mail contracts, both foreign and domestic." That takes in a lot of territory pertaining to what Senator Bingham, vigorously but vainly opposing the resolution, mournfully referred to as an "already over-investigated subject." The Vice-President proceeded to appoint a committee composed of Senators Black of Alabama, King of Utah, Austin of Vermont, White of Maine, and McCarren of Nevada. It was noteworthy that

two of the members were chosen from among the three states through which no air-mail line runs. Of the others, Senators Black and King have frequently appeared in open hostility to the way in which air transport was being supported through the postal service. Senator Black, in fact, was the author of the inquisitory resolution. In last February's Senate fight over the acceptance of the House recommendation for $19,000,000 for the air mail, a fight ultimately won by the opponents by a vote of 38 to 36, Austin and White favored the appropriation, while Black and King opposed it. McCarren is new to the Senate with the present session of Congress. The Black committee appears to start its work of inquiry divided against itself, into two parties approximately equal.

The new investigation, which promises to be of unexampled thoroughness, will probably start early this summer and continue for several months. In the meantime, we have before us the report of the Mead Committee and the separate report of Dr. John B. Crane, of Harvard University, retained by the committee as a special investigator—twin documents which jointly led to the drafting of the new Kelly Bill.

The committee's first move was to go delving into recent financial history and operating statistics. What they found in their inquiry moved them to make such observations as that "a feature of the administrative policy of the Post Office Department has been the persistent inequality of the payments disbursed to the different air-mail contractors . . . The large number of variables (in the formula for payment) introduces an element of flexibility which enables the Department to vary the payments to the different lines without theoretically departing from the formula . . . Our findings indicate that some curb on the rate-making powers of the Postmaster General is highly desirable." Dr. Crane in his report went still further. Most of Dr. Crane's criticisms, and most of those made by the committee as well, addressed themselves specifically to the policies of ex-Postmaster General Brown, and especially to the freedom with which he had extended and consolidated routes and rearranged the compensation paid for operating them.

While the general tone of the figures included in the report was what might have been expected, the details and the proofs had never before been available. The Mead report has made it possible for the first time to secure a real measure of the total scope of air-mail activity and of its sub-division.

A self-supporting service

From the new tabulation it developed that two transport systems handle almost exactly four-fifths of the total domestic mail traffic, and receive barely half of the total pay Four systems carry in the aggregate just over 96 per cent of the total traffic. The gross cost to the government for the carriage of air mail in 1932 ranged from 0.198 cents per lb.-mile (on Transcontinental & Western Air) up to 2.075 cents per lb.-mile on one of the smallest systems. Though T. & W. A. showed the lowest cost for a complete system, the lowest for a single contract route (0.150 cents per lb.-mile) went to the credit of United between New York and Chicago. The committee proceeded in all its subsequent calculations upon the basis that the revenue to the Post Office from air-mail postage, above the cost of ground handling of the mail, might reasonably

be expected to amount to about 0.2 cents per lb.-mile. Upon that assumption, almost exactly two-thirds of the country's air-mail service is already at the point of self-support. About 5 per cent of the service, on the other hand, rendered mostly on short feeder routes in sparsely settled sections of the country, is running at a very heavy loss to the government, and can only be referred to as directly subsidized.

Of course it would be a mistake, though a mistake of which people who should know better are frequently guilty, to suppose that a subsidy in those cases is being given for the sake of aviation. It isn't. It is being given for the sake of the communities concerned, and because of their demand and the demand of their representatives in Congress that they should be given the opportunity for the best and most rapid mail delivery. Neither Congress nor the Post Office Department has so far been willing to take the position that air mail service should be restricted to a few main routes between the great metropolitan areas. Future policy is of course uncertain, but if early self-support for the air mail is to become the first consideration it will undoubtedly be necessary to restrict, or even wipe out so far as that is legally possible, airlines that serve a great proportion of the area of the South and West. Clearly, however, no such change in policy is going to take place without violent opposition from the communities that would suffer most directly.

The Kelly Bill of 1933

When the committee turned from investigation to construction, they prepared the bill which was introduced under the name of Congressman Kelly. The Kelly Bill, perhaps with some minor amendments, seems to be in strict accord with the administration's general desire to make all government activities as far as possible, and as quickly as possible, self-sustaining. It might readily be accepted as an administration measure, were it not for the pending Senate investigation. With that hanging over the head of the air transport business, it seems most probable that the development of air transport policy and the passage of new legislation will be allowed to lie dormant until the Senate Committee reports its findings. In the meantime, Congress is engaged in equipping the President with the authority to cancel transportation contracts, and Assistant Postmaster-General Howes told the House Appropriations Committee, in connection with the possibility of cancellation, that "we will have to cut off about $5,000,000 more, at some place."

Those who drafted the Kelly Bill established themselves flatly upon a flat determination that the air mail ought to carry its own weight economically within the next few years. With that in view, the bill provides that as rapidly as possible the present route certificates shall be converted into route warrants, under which all carriage of air mail would be paid for at a normal base rate of 0.2 cents per lb.-mile. It was further provided, for exactly what reason has never been apparent, but presumably because the committee had a very strong prejudice against large airplanes, that the payment should not in any event exceed 50 cents a mile. If those rules were to be put into effect immediately in exactly that simple form, they would result in a decrease of at least 23

per cent in the compensation of every existing mail contractor, and a reduction of more than 75 per cent in every case except three.

But the bill includes a shock-absorber. To provide a period during which passenger business can be developed to the point of enabling the lines to sustain so large a cut in their mail pay, it is provided that the Postmaster General may in his discretion pay to any operator an additional sum not to exceed 25 cents per airplane mile. The additional payment would be a frank subsidy, and its amount would be based upon an audit of the contractors' accounts, the money presumably being doled out at such a rate as would barely save the most hard-pressed of the carriers from total financial submersion. In any event, the bill provides that all such additional payments would have to terminate on June 30, 1939. Roughly speaking, to keep themselves in as good a condition as they are in now, most of the operators would have to increase their combined mail and passenger traffic to about five times the present magnitude during the six-year probationary period. That would be far from easy, but by the same token it would be far from impossible. In the case of two or three lines now handling the densest traffic, a 50 per cent increase in total traffic would be enough to permit carrying on under the unsubsidized regime as well as at present, even without any further economies in operation.

Even with the 25-cent extra payment for each mile flown, it would still be true that most of the smaller operators would be a good deal worse off than they have been in the past two years. Even if they were given the maximum payment allowed by the bill, three of the contracting systems would suffer a loss of more than one-third in their total compensation, as compared with that which they received in 1932. Such hardship would result in some cases that some of the interested Congressman have shown themselves friendly to an increase of the maximum subsidy allowance to 40 cents a mile during the initial period. Growing passenger traffic would help to fill the gaps, but as yet passenger business plays a minor part in providing gross income. A study of the passenger traffic on the air mail lines during the first eleven months of 1932 showed the ratio of passenger revenue to mail revenue to range from .05 to .45, with Pennsylvania Air Line having the highest proportion of passenger income. The percentage of occupancy of passenger seats available for sale during the same period ranged from 10 to 53, with T. & W. A. in first place and United Air Lines a close second.

What the operators think

The air mail operators, so far as they have expressed themselves, are in full accord with the idea of gradual elimination of subsidy and the attainment of full self-support. There is even some scattered feeling in favor of an immediate transformation to a flat payment of 0.2 cents per lb.-mile, with not even a temporary additional allowance. The prevailing sentiment at a hearing in Washington late in April, however, was in favor of the general plan of gradual suppression of extra payments, but firmly opposed to any plan that would make compensation depend upon an audit of operation costs. The operators as a whole object to a scheme that seems to suppress the rewards of efficiency by holding out the promise of the largest subsidy payments to the lines that are least economically run and have had least success in building up commercial traffic. They prefer rather the guarantee of a fixed income per mile (45 cents is suggested) and a gradual decline in that amount until at the end of a few years the guarantee would have disappeared, and the flat 0.2-cent-per-lb.-mile scale will reign unchallenged. Several of the contractors also object vigorously to the 50-cent-per-mile maximum, though upon that point there is some difference of opinion in their own ranks. Upon most of the major points, however, the carriers that have made any expression of their views are essentially harmonious. How far American Airways will be in accord with the rest of the group is not yet known, for no representative of that company has yet given official testimony.

To bring the air-mail revenue up, and to regain the ground lost when postage rates were raised last summer, the new scheme includes a revision whereby the rate on letters and packages would henceforth be fixed at 5 cents for each half-ounce. The bill further calls for the creation of an air mail postal card, which would weigh about one-eighth of an ounce and would be sold for 2 cents, including both postage and the card itself. There is a strong sentiment among the operators, and a certain sentiment in Congress as well, for the further inclusion of a special letter-envelope of the type proposed in AVIATION last May by Mr. Rushton of Omaha, or an "airbrief" as Colonel Paul Henderson has named it, to be sold and carried at a 3-cent rate. Both postal cards and airbriefs would bring a larger revenue per pound to the government than ordinary mail matter at the 5-cent rate.

Possible help for independents

Another Kelly Bill provision would extend a helping hand to a few of the transport lines that now have no mail contracts by permitting the Postmaster General to put air mail onto their ships, provided only that their routes do not parallel those for which route warrants may have been given. Payment in such cases would be a flat 0.2-cent-per-lb.-mile, with no possibility of extra allowance. Another stipulation prohibits any company having an air mail route warrant from holding any interest in the ownership of any other air mail carrier. Clearly the intention is that each system, even though it be as far flung as United Air Lines, T. & W. A., or American Airways, shall have a single route warrant to cover its entire service. The prohibition on inter-locking ownership is presumably aimed at future attempts to suppress competition, would not appear to affect present holding companies at all. The forthcoming Senate investigation may show itself less friendly, but the responsible committee in the House of Representatives has indicated no desire to destroy the existing financial structure of the industry.

It is rather a remarkable fact that the provisions of the new bill, based upon a careful consideration of six years of operating experience with the contract mail, should be so very closely similar in some respects to the Kelly Bill of 1922 and its immediate successor, the Steenerson Bill of the same year. Eleven years ago Congressman Kelly introduced a bill to permit of the letting of air mail contracts with payment at a maximum rate of 0.1 cent per lb.-mile—a figure, which, as experience has made evident, would have been far too low to permit of staying in business then, and is somewhat too low even now. The Steenerson Bill raised the proposed rate to 0.2 cents per lb.-mile, or exactly the same allowance that is being recommended now, eleven years later. It had as a supplementary feature, however, a grant of authority for the Postmaster General to send ordinary first-class mail by air at a considerably lower rate per lb.-mile—a provision that may well be paralleled in some legislation within the next few years, though it is receiving no consideration at the present time.

Corrections

ATTENTION has been called to certain incorrect designation in model number on page 160 of the May issue of AVIATION. The Wright engine in the lower left hand corner should be captioned R-760-E instead of R-670-E. The fifth and sixth columns of the table refer also to Models E1 and E2 of the R-975 series.

Through a difference in interpretation of the terminology of specifications, the useful load of the Pitcairn PA-19 cabin autogiro was given incorrectly as 770 lb. in the Directory issue. The correct figure including payload, is 1,360 lb.

It should be noted that the maximum speed given on the three-view drawing of the Waco C on page 155 of the May issue has been improved upon in the latest model, as pointed out in the text on the same page. The current top speed is 145 m.p.h. and 125 m.p.h. cruising, with the Continental 210-hp. engine.

Although it is a matter of general information that controllable pitch propellers provide a definite improvement in such performance factors as take-off, climb, and single-engine ceiling of multi-engine ships, it is not always realized that their use increases cruising speed. The series of tests herein described, which were conducted by the reasearch division of the United Aircraft & Transport Corporation at Rentschler Field under the author's direction, were sufficiently convincing to result in a decision to install controllable pitch propellers on the last 30 of the 60 Boeing Model 247 transports now under construction for United Air Lines.

Controllable pitch propellers in transport service

By Charles Hugh Chatfield

Research Division, United Aircraft & Transportation Corporation (of Connecticut)

ALTHOUGH the speeds of transport airplanes have been increasing for many years, it is only relatively recently that these gains have been attained more by reduction of airplane drag than by increase in engine power. So long as power loadings were being progressively reduced, all the airplane performance characteristics except range and endurance were automatically improved, but now that higher speeds are accompanied by stationary or even increasing power loadings, the limitations of the fixed-pitch or ground-adjustable propeller have become more and more apparent.

The wide disparity between take-off and maximum speeds of a modern airplane means that a propeller designed for the latter condition is not particularly well suited for the former, for its high blade angle tends not only toward a reduction in efficiency at low forward speeds, but also to so high a torque coefficient that the engine in take-off, even at full throttle, fails by a substantial margin to reach its rated speed, and consequently cannot deliver its rated power. Thus a relatively low thrust per rated horsepower may be combined with a rather high airplane weight per horsepower, with the result that acceleration in take-off leaves something to be desired. If a supercharged engine is used which requires a throttle-stop at low altitudes, the take-off performance is further impaired.

To a lesser extent than in take-off, the effectiveness of the power plant is reduced in climb because the characteristics of the maximum-speed propeller differ materially from those of one for the reduced forward speed of the climbing condition.

In a multi-engine airplane, the condition of flight with one engine out of action is analogous to that of climb, and the reduction in airspeed caused by stopping an engine results in a loss of thrust available from the remaining engines.

That the controllable pitch propeller affords marked improvement in take-off and climb, and in flight with one dead engine is generally known. It has perhaps not been so widely realized, however, that the ability to change blade angles in flight often makes possible also an improvement in airplane cruising speed.

Now that a serviceable propeller of the controllable type is available, it is felt that there may be some interest in specific data on the performance of a modern high-speed airplane thus equipped. The machine in question is a Boeing Model 247 transport airplane with two direct-drive Wasp series S1D1 engines developing 550 hp. at 2,200 r.p.m. at 5,000 ft.

To investigate the effect of controllable propellers on the performance of one of these airplanes, flight tests were made at Rentschler Field in Hartford in April and May of this year. Since previous tests made by Boeing Airplane Company at Seattle with several designs of Hamilton-Standard fixed-pitch propellers had shown that best all-around results were obtained with three-blade propellers 9 ft. 1 in. in diameter, these were accordingly used in the Hartford tests to establish a basis for judging the gains in performance due to the use of the controllable propellers. These last propellers were of the new Hamilton-Standard hydro-controllable type, 9 ft. 2 in. in diameter, with two blades.

The weight of the two-blade controllable propellers was very nearly the same as that of the three-blade fixed-pitch propellers.

It will be noted that while the tests of cruising speed and of climb with two engines were made at the original gross weight of 12,650 lb., those of take-off were conducted at the new gross weight of 13,100 lb. For the tests of single-engine ceiling the airplane gross weight was less with the fixed-pitch than with the controllable propellers, but for each of the other comparative tests of controllable and fixed-pitch performance, the gross weight was kept constant. The test results follow:

Take-off

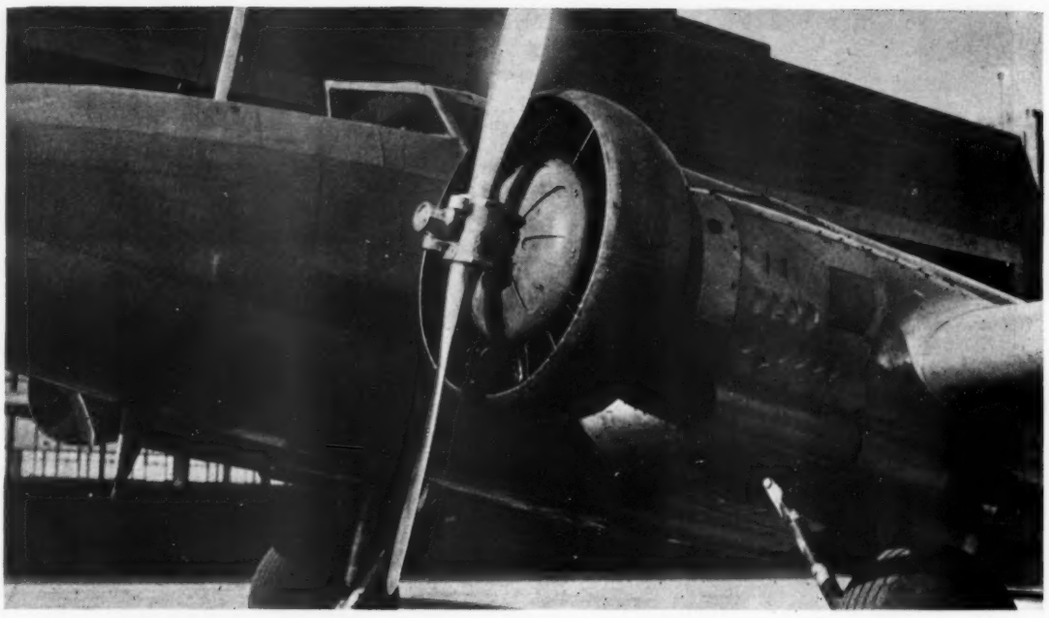
With an airplane gross weight of 13,100 lb. and an engine manifold pressure of 34 in. Hg. absolute, the comparative figures are shown in Table 1.

Table I

Propeller	Controllable (low-angle setting)	Fixed-pitch
Take-off distance (ft.)	740*	925
Take-off time (sec.)	15.2*	19.0
Blade angle at 42-in. radius (deg.)	15.9	18.3
Engine speed near end of take-off (r.p.m.)	1,930	1,650

*Take-off improvement with controllable propeller: Distance, 20 per cent; Time, 20 per cent.

The take-offs were all made from the grass surface of Rentschler Field, and the results have been reduced to the no-wind condition, although at no time during the take-off tests was the wind velocity over 7 m.p.h. The figures given are in each case the average of at least three take-offs. The brakes were set at the beginning of each run, as this method of testing has been found to give



Hamilton Standard controllable pitch propeller installed on the Boeing 247.

more consistent results than that of releasing the brakes before the throttles are opened.

Climb with both engines

The gross weight of the airplane was 12,650 lb. for the two engine climbs, and the engines were operated at full throttle at the critical altitude of 5,000 ft. Table 2 gives the climb data.

Table 2

Propeller	Controllable (low-angle setting)	Fixed-pitch
Rate of climb at 5,000 ft. (ft. per min.)	985*	810
Climb in 10 min. (ft.)	9,500*	8,300
Blade angle at 42-in. radius (deg.)	15.9	18.3
Engine speed in climb at 5,000 ft. (r.p.m.)	2,150	1,835

*Climb improvement with controllable propeller: At 5,000 ft., 22 per cent; In 10 min., 14 per cent.

The airspeeds of best climb were determined by preliminary sawtooth climbs in the usual manner, and the figures given above have been reduced by Diehl's method of N.A.C.A. standard atmosphere.

Ceiling with one engine

The one-engine ceiling tests were made with wheels up; one engine was throttled clear back, and the other was run at full throttle. Tests were first made to determine minimum rates of descent at two altitudes above the one-engine ceiling, and the rate-of-descent curves plotted from these data were produced to zero rate of descent. The one-engine ceiling thus obtained was verified by level flights at that altitude. The figures are shown in Table 3.

These results have been reduced to N.A.C.A. standard atmosphere by Diehl's method. The blade angle of the controllable propeller was 15.9 deg. at the 42-in. radius, and the speed of the engine of which the throttle was open was 2,090 r.p.m.

Cruising speed

The use of controllable propellers permitted a high-angle blade setting such that in level flight at 5,000 ft. the engine inlet manifold pressure was 28 in. Hg. absolute at an engine speed of 2,000 r.p.m., and the engine power was therefore 75 per cent of the rated power,

Table 3

Propeller	Controllable (low-angle setting)	Fixed-pitch
Ceiling with one-engine (ft.)	4,000*	2,000†
Airplane gross weight (lb.)	13,100	12,650

*Ceiling improvement with controllable propeller; 100 per cent. †This figure was not determined in the Hartford tests, but the value given is known to be conservative.

this 75 per cent being substantially more than the output at this same cruising engine speed with fixed-pitch propellers. To obtain this result with fixed-pitch propellers would be impracticable because of the marked adverse effect of the high blade-angle on take-off, climb, and single-engine performance. The improvement in cruising speed at 5,000 ft. shown below is therefore a direct consequence of the use of the controllable propellers. The figures in Table 4 are for a gross weight of 12,650 lb.

Propeller

It should of course be understood that an engine speed of 2,000 r.p.m. with a manifold pressure of 28 in. is entirely permissible for normal cruising operation but that as it is undesirable to exceed either of these limits, the cruising power with fixed-pitch propellers is governed by the first limit reached, that is, by the limiting engine speed.

The maximum speed at 5,000 ft. with full throttle was only 1 m.p.h. less with the controllable propellers than with the fixed-pitch propellers; this is considered unimportant in view of the gain in cruising speed. It would, of course, be possible, if the gain in cruising speed were not desired, to set the high-angle position of the controllable blades so that the engines would turn at their rated speeds at full throttle, thus maintaining the maximum speed.

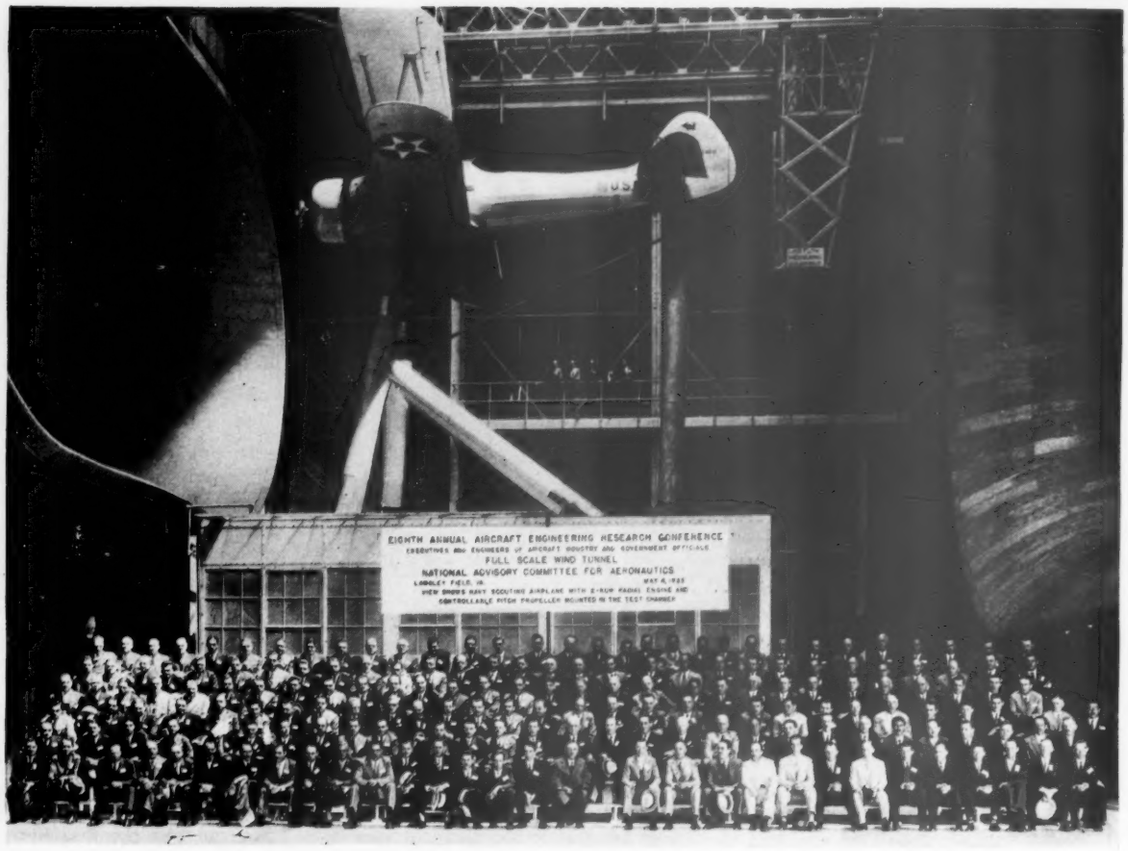
Another possibility is that of retaining the higher value of the high-angle setting, but running the engines somewhat slower, thus obtaining the cruising speed originally given by the fixed-pitch propellers, but with a definite improvement in fuel economy.

As a result of the improvements in airplane performance shown by these tests, the controllable propellers are to be installed on the last 30 of the 60 Model 247 airplanes being built by Boeing Airplane Company.

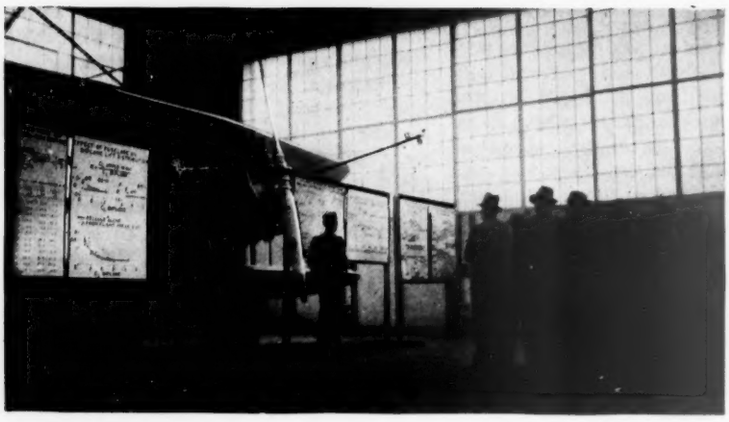
Table 4

Propeller	Controllable (high-angle setting)	Fixed-pitch
Cruising airspeed (m.p.h.)	171*	162
Engine speed (r.p.m.)	2,000	2,000
Intake manifold pressure (Hg. absolute)	28.0	25.7
Power of each engine (b.h.p.)	395*	345
Blade angle at 42-in. radius (deg.)	21.0	18.3

*Improvement with controllable propeller: Cruising speed, 5½ per cent; Power of each engine, 14½ per cent.

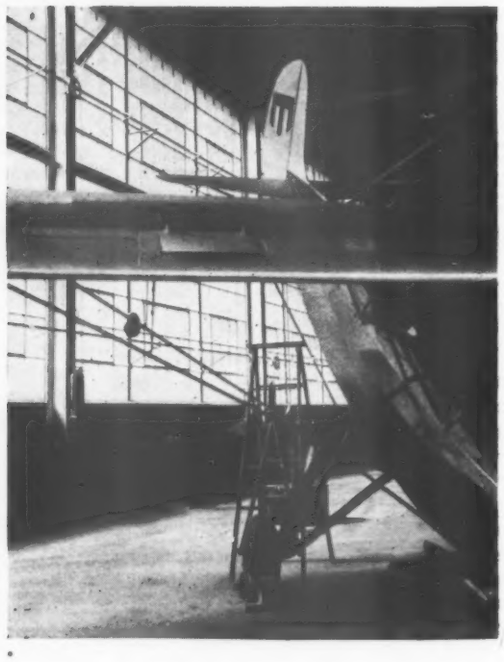

EIGHTH ANNUAL AIRCRAFT ENGINEERING RESEARCH CONFERENCE
FULL SCALE WIND TUNNEL
NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

Above: A new setting for the annual photograph. The full-scale wind tunnel.



Left: One of the airplanes used in tests to determine load factors in flight.

Below: A spoiler installation on the Fairchild 22 airplane displayed in the Flight Test Section.



At Langley Field

Three views of the Eighth Annual Engineering Research Conference

The N.A.C.A. receives callers

Standard procedure is modified at this year's conference to accommodate additional guests and present more subject matter

THE ANNUAL engineering conference of the National Advisory Committee for Aeronautics has outgrown its time-worn setting and the program has been altered in some details to accommodate the ever-increasing hosts of guests and the wealth of subject matter to be presented. The Officers Club at Langley Field has become too small to hold the visitors at luncheon and the spreading chestnut tree that furnished background for so many conference pictures has been cut down to clear space for a new Army Building. Even the day has become too short in which to tell the story of the committee's accomplishments, but, under the guidance of Dr. Joseph S. Ames, chairman of the committee and Henry J. E. Reid, engineer in charge of the laboratories, adherence to schedule remains inflexible.

Changes other than those necessitated by expansion were also noted at the eighth of these annual conferences. Breakfast and dinner were served on the Washington boat instead of at the Hotel Chamberlain, which has been closed. This arrangement necessitated a rising hour of 5:45 a.m. for those on the Washington boat and a somewhat earlier departure than usual from Langley Field, eliminating the usual afternoon flying activities at the field. Because of the necessarily long morning session, the discussion of the work on lift increasing devices by Mr. Fred E. Weick was held over until after luncheon and a simultaneous session on power plants was conducted in another building by G. W. Lewis, director of aeronautical research. These afternoon conferences made it impossible to hold the usual discussions in which research suggestions are made by visitors to the conference.

Attendance was greater than ever before and many representatives of the industry came by air. In spite of this, accommodations on the Washington boat were filled and the number of persons to whom luncheon was served in the Full Scale Wind Tunnel building was the largest that could be accommodated with the present facilities.

Each year the regular visitor is more impressed with the increasing value of the committee's work for the industry and the intensive and efficient use of laboratory equipment. With symphonic precision each research theme is treated by several sections of the group and the results are blended to form a mass of conclusive and incontestable scientific information. Wherever possible wind tunnel data are compared with full-scale flight test making it possible to check not only the results but the accuracy of the testing equipment and methods.

The morning session

The morning session began as usual with a summary of the work of the Aerodynamics division by its chief, Mr. Elton W. Miller. Mr. Miller called attention to the recent increases in aerodynamic efficiency due to drag reduction and mentioned that, whereas airplanes previously wasted two-thirds of their power in the generation of turbulence, now only one-half of the power available is lost by imperfect streamlining. Outlining the methods of studying drag, he discussed first the problem of wing-fuselage interference. A study of the position of the wing with respect to the fuselage showed the drag to be a minimum when the wing was located just above the mid-wing position. An interference value of —5 per cent in that position compared with a value of +50 per cent with the wing at the bottom of the fuselage. With the best fillet, one having a large radius of curvature aft, a value of —15 per cent was obtained. Any fillet form was found to reduce interference to zero. A study of airfoil nose curvature showed that small changes in radius make but small differences in lift. A sharp-nosed airfoil, having a basic radius .01 of the chord, showed a reduction in maximum lift of about 30 per cent.

A new propeller section, designated NACA 216, with sharper nose and a maximum ordinate farther back than that of the Clark Y (40 per cent from leading edge), has been tested in the high-speed tunnel. When the ratio of the airspeed to the speed of sound was .83, this section had one-third less drag than the Y but twice the drag obtained at a value of the same ratio of 0.7.

A systematic investigation of the form of NACA cowling is under way as a joint project of the Aerodynamics and Power Plants divisions, and the work on wing-nacelle location continues in the Propeller Research Tunnel. In general, tractor installations have been found to be better than pushers and the optimum location from the standpoint of efficiency and drag is that with the propeller directly ahead of the leading edge. In this position a combination of cowling and fairing reduces the power required to overcome the drag to about 1 per cent of the output of the engine. The drag of idling, stopped, and free-wheeling propellers has been studied and the advantage of the controllable pitch feathering type is clearly shown.

The Cyclogiro

"Lift without speed" was the text of the opening portion of the talk by J. W. Crowley, Jr., chief of the Flight Research section, who has been conducting a special study of rotating wing systems of all types. It was Mr. Crowley who introduced to the audience the "cyclogiro," the paddle wheel rotor design, sponsored in this country by Haviland H. Platt and in Germany by Dr. Adolph Rohrbach. Computations indicate that a 3,000 lb. airplane utilizing this principle, with constant velocity rotor and cams, would attain a speed of approximately 100 m.p.h. with an engine of 300 hp., assuming that 270 hp. remained after gear friction losses. The power required would be a minimum at 45 m.p.h. and increase 60 per cent at zero air speed, and 90 per cent at 100 m.p.h. The vertical rate of climb computed was 780 ft. per minute and the maximum rate of climb 1,800 ft. per minute.

To determine the effects of stabilizer location on yawing moment, as a part of the spinning investigation, three vertical and three horizontal positions were tried and it was found that the damping in yaw was increased 50 per cent by lifting the horizontal tail to the top of the rudder and 25 per cent by moving the surfaces back a distance of two-thirds of the chord.

Fin area and its effect on spins was also studied and it was learned that increasing the size of the fin and carrying fin area forward improved the spinning qualities. The change in disposition and quantity of the fine area from the smallest to the largest values reduced the number of turns necessary for recovery from an indefinite number to 1½.

The effect of control heaviness on probable load factors has been investigated and it has been found that the heavier the controls the lower the acceleration. When the stick force necessary to obtain 6G and 180 lb., the maxi-

mum normal acceleration in recovery from a dive was 4.59 G. When the force was 10 lb. acceleration in recovery was 7.2 G. From 50 lb. to 125 lb. control heaviness makes little difference. For load factors in inverted maneuvers the limiting factor was found to be the physiological resistance of the pilot, —5 G being the maximum to which a pilot will subject himself.

The results of the installation of the V-G recorder on a number of commercial transports have given some clue as to the frequency of gusts. The maximum vertical component of a gust recorded (in 1,300 hours flying time) was less than 30 ft. a second. A gust producing a vertical velocity of 26 ft. per second would produce a load of 3.5G when cruising at 120 m.p.h. and 5G at 200 m.p.h.

Power plant progress

Reviewing the accomplishments of the Power Plants division Mr. Carlton Kemper told first of the problem of cooling of double-row radial air-cooled engines. Studies have been made of the fin pitch, width, and thickness, the pressure differences and quantity required of cooling air, and the problem of cooling the rear cylinders in two-row engines.

A study of the effect of the distance from fin to baffle and temperature distribution showed that the closer the baffle to the cylinder the more effective the cooling. Baffles must be at least within .2 in. of cylinder.

Progress has been made in the adaptation of safety fuel (125 deg. F. flash point) and it has been possible to obtain the same output and consumption as that obtained for regular gasoline with normal valve arrangement. With 130-deg. valve overlap and 2-in. mercury boost it has been possible to obtain a B.M.E.P. of 180 lb. per sq.in. and a consumption of .47 lb. per hp.-hr. starting from cold by the injection of gasoline into the manifold.

The single cylinder, two-stroke-cycle compression ignition engine mentioned at last year's conference has been completed and put in service. The cylinder has four valves at the top and air is introduced at the bottom in a swirl, no fuel being lost at the exhaust. B.M.E.P. values up to 118 have been obtained with fuel consumption of .52 lb. per hp.-hr. At a B.M.E.P. of 100 lb. per sq.in. the fuel consumption was .45 lb. per hp.-hr.

Mr. Kemper concluded by outlining tests in which hydrogen was used as fuel for compression-ignition engines with the ultimate objective of increasing payload and eliminating the water recovery system weight in airships. No fundamental changes in the fueling system are necessary for the use of hydrogen and it is estimated that in an airship of 6.500,000 cu.ft. employing inner hydrogen cells surrounded by helium cells, and burning hydrogen in the engines, an increase of 35 per cent in range and 62 per cent in payload could be obtained.

The towing basin

Within the fortnight preceding the conference the capacity of the new towing basin at Langley Field was increased from 15 to 50 runs per day by the installation of wave surpressers, consisting essentially of flat rectangular screens set just below the water level and at intervals along the sides of channel. These reduce the time necessary for the turbulence to subside after each run. Mr. Starr Truscott, who is in charge of the basin, outlined the program, discussing first the effect of length and beam on the resistance of a hull model. The hump resistance falls off with an increase of either dimension, while the high-speed resistance varies in the opposite way with particular respect to the changes in beam. A hull form designated NACA 6 was found to be 10 per cent better than the 1926 Macchi racer. It has the same sections as the Macchi but less rise at the bow in profile and greater beam.

A visit to the laboratories

An excellent opportunity to visualize the functioning of the cyclogiro was afforded in the smoke flow tunnel in the variable density building through the efforts of E. N. Jacobs and John Stack.

In the power plant section the new two-stroke cycle single-cylinder test engine which has run 100 hours at speeds up to 2,000 r.p.m. and the apparatus for the introduction of hydrogen into a compression ignition engine was shown.

The study of airplane load factors was discussed by R. V. Rhode in the flight test section. Other exhibits in the flight test section included the preliminary results of a systematic study of blind areas in cockpit design. A reference hemisphere with the pilot's eye as the center, and having parallels of latitude and meridians of longitude on its surface, is the basis of the system together with a sighting device which is placed at the eye position. Results so far indicate that typical tractor biplanes were from 40 to 75 per cent blind.

An unusually large number of charts were arranged on sliding rows in the Propeller Research Tunnel and most of them discussed by Donald Wood, related to the work on nacelle and propeller locations. The drag of a streamline wheel was found to be 17 per cent lower than that of an ordinary wheel, while the drag of a low-pressure tire was 2 per cent higher, and of an extra-low-pressure tire, 19 per cent higher than one of the ordinary types.

In a retractable landing gear study in the Full-Scale Tunnel under the direction of Smith De France it was determined that the resistance of the Lockheed Altair landing gear in extended position is twice that in its retracted position. The presence of landing gear wells made no difference in drag. Resistance of rivets on airfoil surfaces also have been studied.

After luncheon the conferees gathered to hear Fred E. Weick.

Increased lift, lateral control

Maximum lift coefficients as high as 3.17 have been obtained for the Fowler wing with flap extended, but the addition of a Handley-Page slot in that arrangement resulted in but meager increases. By developing the slot through modification of the slat, a value of 3.62 was obtained and the addition of another slot at the rear resulted in an increase to 3.76. Through the use of the Wragg auxiliary flap at 45 deg. the lift coefficient was raised from 1.37 to 1.81 [based on total area]. The best auxiliary airfoil forward had a chord of .1 to .15 of the wing chord and was level with the upper surface of the wing and located about one-third of the chord length ahead of the leading edge.

Variation of the chord of a split flap resulted in a rapid increase in maximum lift up to 20 per cent of the wing chord without any appreciable gain thereafter. Cutting away the flaps from the tip resulted in lift reduction gradual at first, increasing rapidly beyond the semi-span point. Cutting off from the center resulted in rapid lift reduction at first, becoming more gradual later.

Yawing moments observed in flight corresponded to those measured around the wind axes rather than body axes. No ordinary aileron was satisfactory in yaw at high angles of attack in or about the stall and none gave control above the stall. Spoilers were found satisfactory in that region, but there is an appreciable lag in their action. With a retractable spoiler the rolling moment was higher at the stall than throughout the range of angles and the yaw was high and of opposite sense.

Referring to the lag of spoilers Mr. Weick described flight tests in which the ordinary aileron gave a maximum angular velocity in roll of .3 radians per second in six seconds, immediately. This was compared with the swing spoiler type which gave an angular velocity three times greater in 1.8 seconds but none for the first .5 seconds, and the retractable spoiler which showed values of 1.1 r.p.s. in two seconds but required .7 seconds to show any angular velocity.

With upper surface aileron and split flap the roll was normal and the yaw much improved and with external ailerons attached to the upper surface at about 25 per cent of the chord, good roll and positive yaw were obtained up to 30 deg.

Balancing tabs attached to the trailing edges of the ailerons were tried and found to be very effective up to 15 deg., but the control was bad above that point.

View of shop from end of assembly line.

Engine overhaul divorced from engine manufacture

A survey of United Airports of Connecticut, Inc., engine servicing shops at Hartford

ACTING on the theory that the owner of airline equipment is responsible for its upkeep, practically every operator in this country and abroad has installed his own shops for servicing and overhaul of airplanes and engines.

There are few exceptions. In France, for example, Air Union, an operating company, is so closely associated with the manufacturer of its equipment (the Farman Works) that except for routine servicing and checking, all airplanes and engines are sent at stated intervals to the shops in which they originated for complete inspection and overhaul. Elsewhere in Europe and in the United States, however, the trend has been in the opposite direction. There are now a dozen or more well-equipped shops scattered about the country (practically all of them owned by transport lines) where it is possible to overhaul and to practically rebuild, if necessary, all makes of radial engines. The engine manufacturers realizing that it is to their advantage to maintain close liaison with the users of their equipment have established extensive servicing organizations to keep in touch with outlying units to keep their practices up to factory standards at all times. Beyond such co-ordination of services, however, some of the leading manufacturers of engines have found it desirable to divorce the purely manufacturing and the purely servicing functions within their own plants, and to set up separate shops whose primary function is to take care of the overhaul of equipment sent in from private owners and from smaller airlines who do not maintain their own shops. At the same time these shops serve as experiment stations in which to develop new methods of overhaul which, when properly broadcast, tend to simplify and standardize the work of outside shops.

An excellent example of a set-up of this sort is to be found in United Airports of Connecticut, a subsidiary of the United Aircraft and Transport closely associated with the Pratt & Whitney Aircraft Company at East Hartford, Conn. This company not only supervises certain airport operations as its names implies, but more particularly functions as an overhaul unit for Pratt & Whitney, leaving that organization free to devote its entire time to the problems of manufacturing. United Airport's main shops are located on Rentschler Field, adjacent to but not connected physically with the engine manufacturing company. At the head of the organization there is B. L. Whelan, veteran pilot and engine maintenance man of long experience. The unit at East Hartford maintains its own hangar, shops and personnel, and only in very exceptional circumstances is it necessary to call upon the manufacturing division for any sort of work on engines.

The United Airport's building on Rentschler Field is a modern brick and steel structure, whose main portion is the hangar proper—160x125 ft.—with sufficient headroom to handle the largest ships now in service. The two ends are fitted with electrically operated canopy

doors, the entire floor is concrete and contiguous with ample aprons on each side. Overhead crane facilities are available for removing and installing engines in airplanes. A brick lean-to along the east side of the hangar provides space for airline ticket offices and waiting rooms, offices for the shop and field executive personnel, weather bureau offices, stockrooms and a propeller overhaul shop. The waiting room and general offices are finished in a distinctly Colonial style which is very attractive.

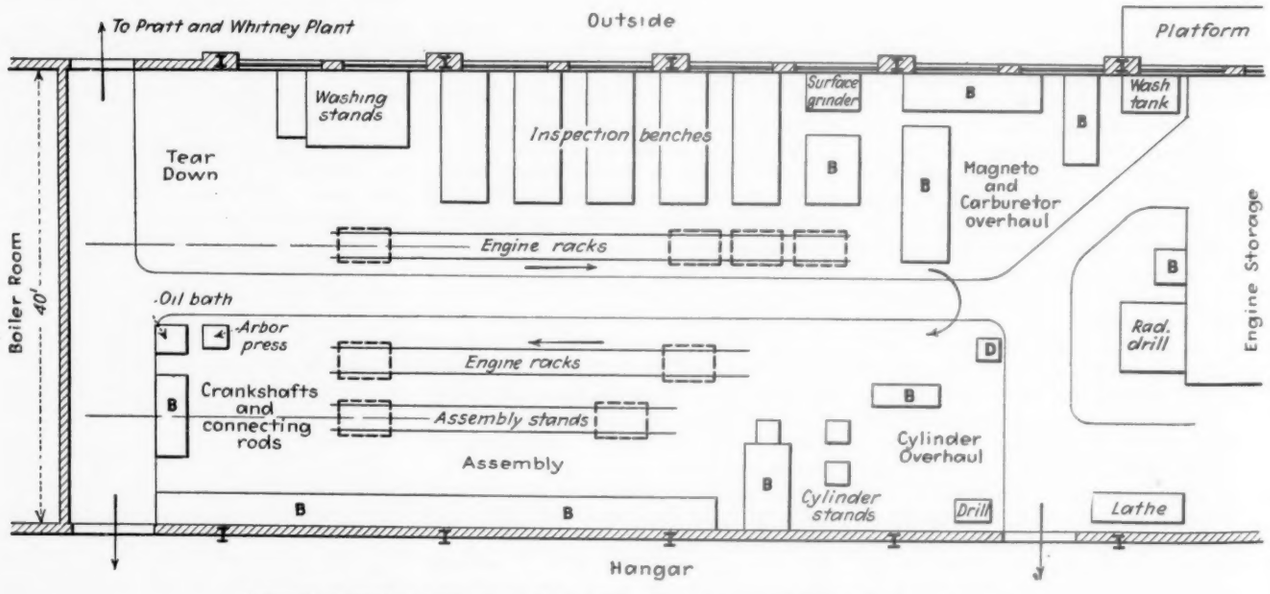
The engine overhaul shops are located in a corresponding brick and steel lean-to 40 ft. wide along the west side. The shop proper occupies a space 40x 100 ft. about the center of the lean-to. At the north end is a caged-off area for storage of engines, and a heating plant for the building occupies a room at the south end. A loading platform opposite the storage space may be reached conveniently over concrete roadways from the manufacturing plant proper or from the aprons. Two wide doors give access from the engine shop into the hangar proper.

The layout has been developed for production line methods of overhaul. All engines whether coming from storage, from the hangar or from outside begin their journey through the shop in the southwest corner. They then move northward along the west wall to the end of the shop, cross over and come down the assembly line to final operation in the southeast corner. From this point they move out to the test stand for run-in and either to the shipping room or back to the hangar for re-installation.

The first operation, as usual, consists of complete tear down and cleaning of all engine parts. As the engine is disassembled all parts are placed in wooden racks with trays and compartments arranged to receive and retain all parts in an orderly manner. Painted parts, such as cylinders, crankcases, induction pipes, etc., are dipped in a hot cleaning compound (Metex), or are sandblasted clean, and all machined parts are sprayed off with light mineral spirits (Varnolene). After cleaning the parts racks are moved to the inspection department, where every piece of the engine is laid out in a predetermined order on the inspection benches, each large enough to receive one entire engine. The parts are spotted on outline drawings scored in the table top. Inspectors thus find every part for every engine in the same place at all times. After inspection the parts which need attention are distribtued to the various sections of the shop with complete written instructions as to what repairs are necessary. Electrical equipment goes to one bench, carburetors to another, pistons and piston rings to another, cylinders and valves to another. As the parts racks travel down the floor mechanics trained especially for work with the various components remove them from the racks, put them back into original condition, either by repair or replacement and return the parts to the racks from which they were taken. By the time the engine is ready to start its return journey through the shop all parts are in order and are ready to go back into place without further delay. During assembly production methods are continued. As the engine passes down the floor groups of men trained to assemble certain units work on those parts only and pass the sub-assemblies and parts on to the next group to do their particular part. By the time the final assembly stage is completed the engine is ready to leave the shop in practically as good condition as when it left the manufacturing assembling line on its first trip out.

Needless to say, the shop is fitted with practically every tool or device known to facilitate the overhaul and inspection of engines. Not only are new tools being developed out of the experience in this particular shop, but suggestions are constantly being received from outside shops which are tested out and, if they prove useful, are incorporated into the standard overhaul procedure. Thus special tools have been developed for inserting and removing bronze valve seats, push rod guides, etc. An interesting and effective clamping device for crankshafts has also been made part of the standard equipment and special sets of tools and fittings produced for the Waddell connecting rod boring tool. A simple test which is in use at Hartford and which has apparently been overlooked by certain shops in the field can be applied to locate cracked aluminum pistons. The pistons are suspended in the air and tapped lightly with a hammer. A trained observer can detect the probable presence of cracks by the quality of the sound. A good piston has a hard metallic ring to it, but one that is cracked has a dead sound. It has been reported that a similar test is made on propeller blades by certain European air lines.

In passing, mention should be made of the quality of the housekeeping at the East Hartford shop. The building itself has plenty of natural light, and conditions in the shop are improved by liberal use of aluminum and white paint on the walls and roof. A good deal of attention is obviously paid to keeping floors and benches in a clean and orderly manner, and the visitor is left with a distinct impression of careful and efficient work being done in an orderly and well-equipped shop.



Lay-out of United Airports of Connecticut, Inc., engine overhaul shop at Hartford.

EDITORIALS

AVIATION

EDWARD P. WARNER, *Editor*

Soak the transport line!

WHEN the great Michael Faraday had begun to achieve some little public fame from those experiments which were to reveal the principles of electromagnetism and assemble them into a coherent body of theory, his laboratory was honored by a visit from the British Prime Minister of the moment. The statesman came to the point at once. "What *good* is it?" Faraday replied: "Well, you see, some day this experiment will grow up and go to work and you will be able to tax it." Air transport has now reached that unhappy stage in its progress. It is necessary, now and presumably henceforth, to watch not only the state of the equipment, the qualifications of personnel, the condition of the weather, and the development of policy in Washington, but also the states of mind of 48 legislatures.

At the present time there are under active consideration in at least half a dozen states new pieces of legislation which would either increase the gas tax that is already paid on the fuel used for transport airplanes, impose a special tax on such fuel, or remove the exemption which it has so far enjoyed under the general tax law. A federal court has upheld the right of a state to collect a tax on fuel used in interstate air transport. If the policy of canceling aircraft refunds were to become general, the transport lines alone would find themselves carrying a new tax load of approximately $1,000,000 a year. About 3 per cent of the total gross receipts of the lines would go into meeting this single type of tax. The aggregate gas tax would exceed the aggregate profit of all the air lines in the United States for the year 1932, and if no other change were to be made from the 1932 status it would put the nation's air transport system as a whole into the red.

That in itself might not be a sufficient argument against taxing air transport fuel. These are tough times, and every individual and every industry must be prepared to be called on for fresh and extraordinary contributions to the public welfare. But there are a few principles of taxation which remain sound even at the bottom of a depression. One of them is that it is foolish for the government to destroy with one hand what it is upbuilding with the other. Another is that no special and onerous levy shall be laid upon any industry or any activity which is not in itself anti-social unless the proceeds are used in some fashion directly and particularly benefiting the group from which they come.

THUS it is absurd that State Governments should be laying a new and punishing tax upon an activity which is being sustained in very large measure, and for very good reasons, by the outlay of the Federal Government. To destroy the existing gas tax refunds would be just about equivalent to a proposal to lay a state tax at the rate of 10 cents per hundred upon the right to send or to receive letters by ordinary first-class mail. It would be even more foolish, for in the case of a general tax on postal facilities the load would at least fall directly on those who used the facilities, while a state tax on air transport fuel would fall rather on the Federal Treasury through making it necessary to increase the amount that would have to be paid by the Post Office to the air mail contractors in order that they might continue to maintain their services.

So much for the first point, which is concerned with logic and good sense. Now to the second, concerned with fundamental justice.

When gasoline taxes are levied upon the fuel used by highway vehicles, the proceeds go back into the highways. While there have been some cases of tax diversion to general funds, they have been exceptional and they have aroused great and righteous indignation. The states provide the highways, and the states collect a special tax to cover the cost. Some of the states are undertaking programs of local airway development and of airport encouragement which will be of great value to the private airplane owner and the fixed-base operator, and in some cases the private owner or the small commercial operator can reasonably be expected to make a special contribution to such work. We have

been rather sympathetic to gas taxes so employed. The transport lines, however, are in a very different position. As a general rule they derive no benefits whatever from the State Government. To impose a specialized tax for which no direct return is made is inequitable. It is unsound tax practice. We do not believe that there is a state in the Union where public opinion would support such a course if the public really understood what was being proposed, and how air transport would suffer as a result. It is up to us to inform them. In every state where a new aviation gas tax is under consideration, the injustice of its application to the transport field ought to be proclaimed before chambers of commerce and service clubs from one end of the commonwealth to the other.

Sanctioned and unsanctioned races

AIR RACING is about to meet an issue that presents itself, sooner or later, in practically every organized sport. We are about to face the necessity of deciding whether or not we are to have centralized control. In baseball, in horse racing, to a large extent in yachting and motor boat racing, and most particularly of all in automobile racing, that same issue has arisen at various times in the past. After more or less prolonged battles and much hard feeling, national organization has triumphed. A fair degree of decency and order has been maintained as a result. Where national organization has been lacking, the way has all too often been opened for the victimization of competitors, and of everyone else concerned, by fly-by-night promoters and racketeers.

The first four days of July are to see two air race meets, each planned to attract competitors and to receive publicity on a national scale. Two thousand miles apart, still they will inevitably conflict in their quests for the entries of spectacular airplanes and famous pilots. Upon the relative merits of the competing locations, and upon the personalities concerned, we express no opinion. Both events are to be directed by men of long experience and unquestioned competence. Both appear to have ample financial backing. But there is one great difference between them. One of them is sanctioned by the National Aeronautic Association. The other is not, for the N.A.A., like the American Automobile Association and for the most obvious reasons, refuses to approve the same dates for two major events of the same type.

We are in for a fight. However it comes out, the immediate results are likely to be bad. It is an unhappy situation from any point of view. To debate it with a minimum of heat, break the main question up into its parts and consider them separately.

1. Is a central controlling and sanctioning authority desirable? To that, in our opinion, there can be but one answer. It is not only desirable, but almost essential if pilots and plane-owners are to be protected against exploitation by a host of side-show managers. Without central control, national and world's records would mean as little as world's championships in wrestling do now. Without central control, it would be virtually impossible to organize a race meet on anything more than a local basis, or to offer inducements that would bring entries from a distance while there were easier prizes to be won on the same dates nearer home.

2. If there is to be a central authority, should it be the N.A.A. or should the N.A.A. be scrapped and replaced by some new agency? That question everyone can answer for himself. We have no cause to plead, but a couple of points deserve consideration before a decision is reached. In the first place, the N.A.A. has no self-perpetuating government. If the members are dissatisfied with the management of the organization's affairs, they have an annual opportunity of making a change. Secondly, decisions on sanctions, and on every other phase of contest policy, are now taken not by any little oligarchy, but by a contest committee of 29 members, including representatives of the Army, Navy, Department of Commerce, National Advisory Committee, and a number of leading groups in the industry. Thirdly, any attempt to supplant the N.A.A. would have to overcome the momentum of an established tradition and a going concern, and it would have no chance of success unless at least two-thirds of all those actively concerned with air racing lined up to give active support to the revolutionary movement.

3. Assuming that there is a central authority, whether it be the N.A.A. or something else, what attitude should it be expected to take towards unsanctioned meets? On this point, practically speaking, there is no alternative. Circumstances force the decision. Central control cannot survive unless it protects its own standing. Any organization would inevitably do exactly what the A.A.A. did when "outlaw" racing of automobiles became common—exactly what the association controlling professional baseball did some 50 years ago. It would protect itself and those who had taken its sanctions by declaring war upon unsanctioned meets and all who had to do with them. Any other course would be suicidal. The pilot who flies in an unsanctioned event is in the position of gambling either that the authority as present accepted is on the point of being overthrown, or that it will depart from precedent by receiving the wanderers promptly back into the fold, or that there will be a continuing "outlaw circuit" that will offer satisfactory competition and satisfactory prize money for the pilots who have excluded themselves from the sanctioned races. Failing one or another of those developments, he is likely to find himself, at least temporarily, forcibly retired from racing.

NEWS OF THE MONTH

Speed to Chicago

FIRST new fruit of the crop of new high-speed transport planes recently developed by several manufacturers is the new fast service between New York and Chicago by the Valley Route, inaugurated on May 4 by American Airways. Following the Susquehanna Valley through the Delaware Water Gap to Buffalo and thence over level lake regions to Detroit and Chicago, the new service provides the first direct air line connection between New York and the automobile capitol. Curtiss Condors fly the whole route from Chicago to New York in five hours, 49 minutes elapsed time, with actual flying time about five hours. The Westbound flight takes half an hour longer due to prevailing winds. Fare remains $47.50 with 10 per cent round-trip reduction.

Simultaneously, summer schedules went into effect on several other American Airways routes. Its trans-lake Detroit-Cleveland service, flown each summer since 1929 by Transamerican, now an American subsidiary, started its 1933 schedule with three trips daily in each direction. Twin-engined Sikorsky amphibions carrying eight passengers and two pilots take off from Detroit City Airport to land on the lake off the Cleveland Air Depot 55 minutes later. Summer schedules on the company's Montreal-New York line mean a later departure from the Canadian city.

American Airways gets a raise

Among the first to back up through definite wage increases President Roosevelt's program to revive business and increase purchasing power was the Cord Corporation. American Airways, Aviation Corporation, Lycoming Manufacturing Company and Stinson Aircraft Corporation, will benefit by the blanket increase of 5 per cent on all payrolls announced by E. L. Cord.

American Airways recently ordered 2,600,000 gal. of gasoline from the Shell Petroleum Corporation. Third consecutive yearly contract awarded by the air line to the Shell company, it will cover the requirements of a large portion of its central division as well as of the newly acquired Transamerican services.

The New York traffic offices of American Airways are now located at 45 Vanderbilt Avenue, adjacent to Grand Central Terminal.

Speed by Boeing

The East had its first view of the new Boeing high-speed transports which are being put into service on United Air Lines in mid-April. One of the first to be completed of the 60 monoplanes being built for United made the trip from Chicago to New York, with a stop at Cleveland, in four hours and 35 minutes. Some twenty are now in service on the company's lines throughout the country and about ten more were in scheduled operation on the first of June. The new contingent at the Boeing plant in Seattle are to mount Hamilton-Standard controllable-pitch propellers.

Transoceanic clippers

Pan American Airways is definitely enlisted to compete on world trade routes with the far-flung foreign services of Imperial, Deutsche Luft Hansa, K.L.M., and Aeropostale. Contracts amounting to $1,750,000 have been placed for six long-range flying boats, the largest air transports ever to be built in this country. Three will be built by Glenn L. Martin Company of Baltimore and three in the Bridgeport plants of Sikorsky Aviation Company. Products of eighteen months engineering research, the new Clippers are expected to have a range with full load of 2,500 miles in the face of a 30 m.p.h. head wind, and a cruising speed of about 150 m.p.h. (AVIATION, January, 1933). This is far ahead of any performance abroad where no ships of such size have as yet been put into service. No construction details on the Clippers have been released as yet.

Ship-to-shore air mail connections, which at present provide the fastest mail service between the continents, were resumed with the coming of spring weather. The catapult aboard the Europa started the service operated from the two North German Lloyd express liners on May 11, westbound, while the Rimouski-Montreal connection with Canadian Pacific steamers as they enter the mouth of the St. Lawrence began a few weeks earlier.

On Empire services

In January Imperial Airways celebrated the first anniversary of the opening of its London-Capetown service with the announcement that the 8,250-mile run had been made without accident 52 times. Introduction of the new Atlanta type transports with four Armstrong-Siddeley 340 hp. engines giving a top speed of 150 m.p.h. late in April reduced the schedule from eleven to ten days.

Imperial Airways have a new talking point in accident insurance rates for their passengers. On the service to India accident insurance now costs a shilling per £1,000 per day in place of the old rates of 12 shillings for the same protection. A £2,000 policy for the whole trip by air comes to $2.40, 34 cents less than similar protection on the same journey by surface transportation.

The latest system devised by Imperial Airways to give rate reductions to regular users of air transport is a Season Travel Voucher, sold in denominations of £100. Purchasers not only get a substantial discount from regular fares but are freed from the time restrictions put on other forms of reduced rate tickets. Few American air lines offer such inducements to regular customers.

Imperial's London-Paris service, which is operating a new high-frequency summer schedule of five trips daily in each direction, is to have some new equipment at the end of the year. Two transports, accommodating 38 passengers and a crew of four and powered with Bristol Jupiter engines, have been ordered for December delivery.

Britain flies at home

In the shadow of Imperial Airways' foreign services, British internal airways have been developing. The Scottish Motor Traction Company, which last year added an air service to its motor coach operations will extend its work in the new field with fourteen new planes. Eight four-passenger Fox Moths, five twin-engined Dragon Moths accommodating six-passengers and pilot, and two two-seater Tiger Moths bring

Calendar

June 12-Ju.y 10	Soaring Camp, Elmira, N. Y.
July 1-4	National Air Races, Los Angeles.
July 1-4	American Air Races, Chicago.
July 10-23	Fourth Annual National Soaring Contest, Elmira, N. Y.
Aug. 4-7	International Air Races, Portsmouth, England.
September	International Gliding Congress and Meeting, La Banne, d'Ordanche (Clermont Ferrand), France.
Sept. 1-4	International Gordon - Bennett Balloon Race and Air Races, Chicago.
Oct. 7-8	U. S. Amateur Air Pilots Association Charity Air Pageant, Roosevelt Field, Long Island, N. Y.
December	International Rally, Cairo, Egypt.
December 14	Meeting of the Federation Aeronautique Internationale, Cairo, Egypt.

the Scottish fleet up to twenty planes. Regular passenger schedules combined with charter and newspaper delivery services will be operated from Edinburgh through eastern Scotland and northern England, and from Glasgow through the western territory.

Highland Airways operates Monospar cabin monoplanes between Inverness and the Orkney Islands, Scotland's farthest north. Two trips daily in each direction between the islands and the mainland can be made easily, while available surface transport demands more than a day for the journey.

Climax to this mushroom growth of internal air line development on the British island is a regular air service across Bristol Channel between Cardiff and Torquay, popular south Devon seaside resort, being inaugurated by Great Western Railway, the first British railway to make such a venture. Trimotored Westland-Wessex six-seaters painted like the company's parlor cars will make the four-hour train trip in 45 minutes. Imperial Airways is in charge of the first flights of the new service.

For a faster R.A.F.

Almost within reach of landplane record speeds is the new single-seater fighter now being put through official tests by the British Air Ministry. An experimental development of the Hawker Fury which is standard equipment for interception squadrons of the Home Defence Force, the new fighter is powered with an improved Rolls-Royce Kestrel engine, supercharged and with increased compression ratios, and is credited with 250 m.p.h. Elliptical wings tapered towards the tips and streamlined fairings over the wheels further distinguish it from the standard Fury.

Performance figures on all Royal Air Force equipment are expected to go up 10 per cent with the early adoption of a standard fuel of a higher octane number—86 instead of the present 76 octane, on the basis of British tests. American standards would rate the newly specified fuel at about 77, considerably below the 87 octane fuel now used to a large extent by the U. S. air services and racing planes, though not by any commercial airlines. Ninety per cent of Army Air Corps fuel and 50 per cent of Navy aviation gasoline is of 87 octane rating. British chemists have been experimenting for some time with a fuel of high octane rating distilled from coal. As part of the reseach, one R.A.F. squadron is flying on it exclusively.

Gas tax upheld

Third adjudication of the applicability of a Wyoming gasoline tax to fuel purchased by Boeing Air Transport brought a decision important to air transportation. Justice Stone of the U. S. Supreme Court sustained the original decision of the Wyoming Federal District Court requiring payment of the 4 cent tax on gasoline purchased outside the state, but stored at Boeing's Cheyenne and Rock Springs landing fields to be withdrawn to refuel planes flying across the state in interstate commerce. Based upon interpretation of withdrawal of the gasoline from storage tanks as the "use" taxed by the Wyoming statute, the Supreme Court decision reversed the decree rendered by the Tenth Circuit Court of Appeals when the original decision had been appealed by the air line. The precedent for calling the imposition of such a tax a restraint upon interstate commerce and a violation of the commerce clause of the Constitution is thus broken.

Tax exempt

In a change of heart prompted by an analogous decision handed down by Justice Holmes (in the case of McBoyle *vs.* U.S. over the theft of an airplane) the General Counsel of the Bureau of Internal Revenue has exempted seaplanes and amphibions from taxes imposed on tickets for passage in vessels to foreign ports by the Revenue Act of 1928. Since water is involved only in the landing facilities of these aircraft, their inclusion as vessels seemed too broad an interpretation of the word in the light of the attitude of the higher courts. Counsel's past decision had exempted only land planes.

Akron investigations

"Likely to remain forever in the realm of conjecture," is the dictum of Judge Advocate Ralph G. Pennoyer on the cause of the Akron disaster. Evidence brought before the naval court of inquiry revealed only that in the light of hindsight pursuance of another course of procedure might have saved the ship. In Commander Pennoyer's opinion it would be impossible to fix any direct or indirect individual responsibility for the loss of the airship, since any errors in judgment which may have been made were clearly free of negligence or culpability.

Meanwhile the joint Congressional investigation is getting under way. Composed of Senators Kean, Walsh, Johnson and Duffy and Representatives Delaney, McSwain, Harter, Andrew and Hope, under the chairmanship of Senator King, the committee plans to preface its researches with an inspection tour of the Macon to familiarize itself with airship construction features.

Home for the Macon

Almost simultaneously with the Macon's first flights came the announcement that Lakehurst Naval Air Station, home of its sister ship, is to be practically decommissioned in the near future. Awaiting the Macon, destined to operate as part of the Pacific battle fleet, is the recently completed airship base at Sunnyvale, Cal. Boasting a hangar similar to that of the Goodyear-Zeppelin corporation at Akron but embodying radical improvements; the latest in landing equipment, including a telescopic mooring mast and a special 180-ft. stern beam to hold and support the stern as the ship swings freely about the mast; and a superlative helium repurification plant with a 2,000,000-cu.ft. low pressure storage holder for impure helium and high-pressure drums of similar capacity for pure gas, the base represents an investment by the Navy of $4,500,000.

Economies recently ordered by Secretary Swanson of the Navy will affect other aviation bases besides Lakehurst, reducing activities at all stations either to that required for voluntary training or to a bare maintenance status. The Naval Aircraft Factory at Philadelphia and the Naval Air Station at Norfolk will reduce activities to present fleet requirements. Great Lakes Naval Reserve Aviation Base will be closed and reserve bases at Brooklyn, Detroit, Long Beach and Oakland, Cal., Minneapolis, Miami, Seattle, St. Louis, and Squantum, Mass., come in the limited voluntary training category.

Following the trail blazed by six patrol planes from the Pearl Harbor naval air station last fall, 30 navy machines last month made the non-stop flight from Oahu to French Frigate Shoals, across 500 miles of Pacific waters. Led by Commander E. W. Todd and manned by 30 officers and 100 enlisted men, the three squadrons of twin-engined Douglas and Keystone flying boats flew the route, along which surface craft had been stationed at 100-mile intervals, in less than six hours.

Flight pay cuts

Action on the proposals made some time ago by Representative Vinson, chairman of the House Naval Affairs Committee, to cut flying pay of flying personnel in the services came into sight when the Independent Offices Appropriation Bill was reported out by the House Appropriations Committee. The bill would limit the rate of additional pay to $1,440 per year, as well as authorize the President at his discretion to suspend or reduce the rate of extra pay allowed commissioned officers, warrant officers and enlisted men of the Army, Navy, Marine Corps and Coast Guard while on flying duty. Though passage by the House has been accomplished, the military and naval committees of that body are as a whole opposed to such drastic reduction in flight pay and hope the move can be blocked in the Senate and subsequently in conference. Their opinion is that the limit should be placed no lower than the amount provided now for any commander or lieutenant colonel, that the pay of officers of this and lower ranks be untouched, and that the whole readjust-

ment of flight pay should be left to Congress, instead of to the President. Should the suggested limitation ($1,440) be put into effect, the saving to the Army would be only about $150,000, to the Navy about $110,000.

Germany's civil air force

Close upon the heels of the formal appointment of Captain Hermann Wilhelm Goering, Prussian Premier and Chancellor Hitler's right-hand man, as Air Minister came the creation of an air defense body for Germany. Designated the Reich Federation for Protection Against Air Attacks, it is directed by two officers of the old army, Lieut. General Grimme and Major Waldschmidt. Upon the civilian population, however, is supposed to fall the responsibility for developing this supplementary defense system. Another ministerial decree created a special uniform for all German pilots. Not only commercial pilots, but also members of flying clubs and aeronautical associations and government pilots are required to wear it.

Red celebrations

Aircraft had a prominent part in the great May Day parade through Red Square in Moscow. Some 350 planes were reported participants in the maneuvers. Fifty five-engined monoplane bombers led the procession, apparently their first public appearance, since four-engined machines were largest at the 1932 demonstrations, in which 275 planes took part.

A gala send-off for the newly formed Maxim Gorky Air Squadron, about to tour Russia in a publicity campaign, was occasion for celebration in Moscow a few days later. Its purpose is to collect funds for a giant landplane, to be powered with seven engines and equipped with loudspeakers, radio and printing presses, for Soviet publicity on a large scale.

A silver lining

Mourning the losses of aviation's exchequer under the slashing economy régime of Premier Daladier, the French aeronautical press paints a dark picture of the future. L'Air especially bewails the prospect for French attack planes, credited with speeds of only 150 m.p.h., while the foreign press is full of performance figures in the neighborhood of 220. Les Ailes, discouraged by futile budgetary indignation meetings and an Air Minister at Geneva concentrating on plans to restrict military and internationalize civil aviation, has taken up the cudgel for private flying. In collaboration with the Association for Technical Studies in Aviation it has organized the Etats Generaux de l'Aviation Nouvelle. Fostering flying for persons of small means, the new organization for aeronautical propaganda will attempt to secure pilot training for less than $40 and to keep rental charges below $4 per hour.

Further consolation is being derived from the prospect of success for long continued efforts in another direction. Provision made in the budget by Air Minister Pierre Cot for an Advanced School of Aeronautics (akin to a War College) and the formation of a commission to decide its location is regarded as a favorable omen. No previous minister could muster courage for this step.

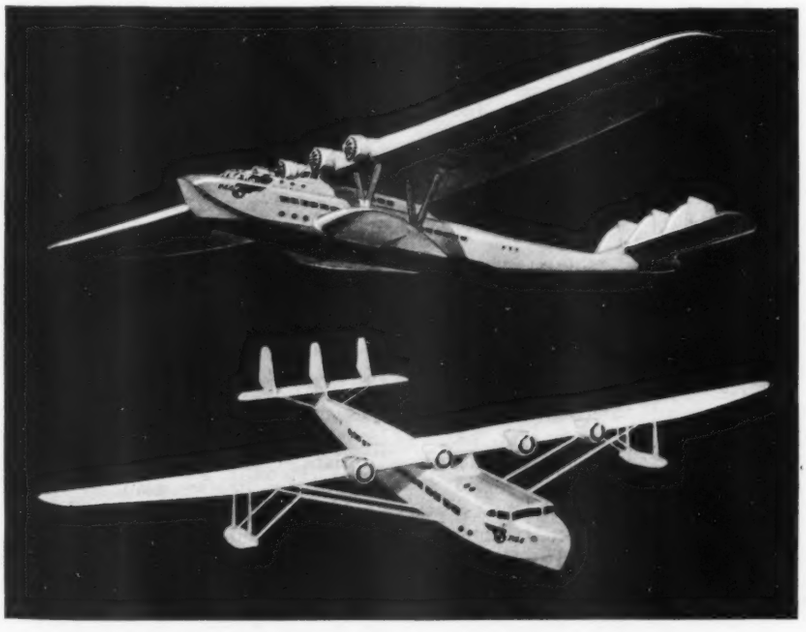
The Italian Ministry of Aeronautics is providing not a single school but flying instruction in 28 cities. Three hundred and six members of junior organizations of the Fascist party, between sixteen and nineteen years of age, are being admitted to the courses.

School news

Flying is cheap these days. Dual instruction rates of $10 an hour make it possible for Harvard Flying Club members to qualify for a solo rating for about $125. Solo rates of $6 an hour for at least three hours a month are the lowest ever available to club members. Also at Penn School of Aviation flying training is $10 an hour, only half the previous charge. Boeing School of Aeronautics at Oakland, Cal., has 30 new students enrolled in its pilot training and mechanics courses.

Casey Jones School of Aeronautics has added a two-year course in aeronautical engineering to its curriculum. Organized three months ago to train airplane mechanics and pilots, the school has had to acquire more floor space to provide facilities for its enrollment of 72 students.

Ryan School of Aeronautics, at San Diego, Cal., has added amphibion training to its flight curriculum. Option of two hours of amphibion instruction will be allowed all private and limited commercial students, while transport students may have ten hours of such activity as part of their regular flight training. Recent tuition reductions make all courses at the Ryan school less than half as expensive as they were three years ago.



FOR NEW TRADE ROUTES TO THE OLD WORLD

As the artist conceives the flying boats ordered by Pan American Airways for transoceanic service. The lower model is a-building in the Sikorsky plant at Bridgeport, the upper at the Baltimore factory of Glenn L. Martin.

School for soaring

Complete details of the soaring training available at the Soaring Camp being operated at Elmira, N. Y., from June 10 to July 9 by the Soaring Society of America and rules of the Fourth Annual National Soaring Contest which is to follow it, were recently published by the S.S.A. Fees range from $50 for the beginner's course to $75 for a complete course, with reduced rates available to those entering during the first ten days of the session. Inquiries should be addressed to the Soaring Society of America, Norwich, N. Y.

Privateer for the Daily News

Among recent purchasers of its planes Amphibions, Inc. of Roosevelt Field lists the *Daily News*, New York tabloid, which has secured a Privateer III for use in reporting and photography. The amphibion, first plane the newspaper has owned, is based at Roosevelt Field

where the paper has long maintained an office. While a large number of American dailies make frequent use of scheduled airlines and charter service, not many own planes as yet, though James V. Piersol, aviation editor of the Detroit *Evening News* has estimated that 10,000 airplanes will be needed to fill newspaper requirements in the next ten years. Another Privateer III was purchased by Jay Holmes, of Port Washington, L. I., for his private use.

In the black

United Aircraft and Transport Corporation started 1933 with an edge of 2 cents per share over earnings for the first quarter of last year. A net income of $432,170 for the quarter March 31 amounted, after preferred dividend requirements, to 15 cents a share on 2,086,550 shares of common stock outstanding. Last year's first quarterly profits were $441,445, 13 cents each on the 2,084,319 common shares outstanding at that time. Passenger traffic on United's transport subsidiary, United Air Lines, was up 32 per cent as compared with last year The manufacturing units report unfilled orders at about the same level as at the end of 1932 (when they were slightly over $9,000,000), shipments during the first months of 1933 having just about kept pace with incoming orders.

While reporting a profit for the first quarter of 1933, Curtiss-Wright Corporation and subsidiaries did not come up to their previous year's record. Current quarterly net profits after depreciation, interest, taxes, and other charges were $4,753, as compared with $302,013, equal to 26 cents a share on 1,141,214 Class A shares outstanding, in the first quarter of 1932. The company's engine manufacturing unit, Wright Aeronautical Corporation, earned $105,384 after depreciation, interest, taxes, and other deductions. Amounting to 17 cents a share on 599,857 no par capital shares, this is about a third the profit reported for the opening quarter of last year.

Aviation Corporation profits

Unique in the annals of Aviation Corporation is its report for the first quarter of 1933. It showed a profit, first in the company's history, for one month of the three. March profits of $14,806 brought the quarter's net loss down to $57,408; barely 7 per cent of the losses incurred during the corresponding period of 1932. Passenger traffic on American Airways, the company's transport subsidiary, increased 45 per cent, while express poundage was nearly three times the previous year's figure.

Bendix Aviation Corporation and subsidiaries, a large number of which are non-aeronautical, incurred a net loss, after depreciation, taxes, interest and other charges, of $267,463 during the first quarter of the current year. During the same period of 1932 the company earned $26,364 before the deduction of federal taxes.

ERNEST R. BREECH

President, chairman of the board, and chairman of the executive committee of reorganized North American Aviation.

Annual reports of two British engine manufacturers are decidedly favorable. Rolls-Royce reports net profits of £150,979 during 1932, some £6,782 better than the figure for the previous year. D. Napier & Son Ltd. showed net profits of £73,730, most of which, however, was due to income on investments. The Napier company is about to start production on its new Lion engine and is completing negotiations to manufacture under license a compression ignition engine of a type not previously produced in England.

Merger proposals become fact

Stockholders of General Aviation Corporation and North American Aviation Inc. on April 26 approved and brought to a close negotiations for a merger of the two companies which have been on the table for months (AVIATION, May, p. 168). Subsequent to the completion of this deal, which gave General Aviation, General Motors subsidiary, control of 43 per cent of North American, additional stock purchases were made to bring General Motors holdings up to 51 per cent. At an organization meeting held shortly afterwards, Ernest R. Breech, general assistant treasurer of General Motors, was elected president of North American and chairman of its board and executive committee. Richard W. Robbins and Thomas B. Doe are vice-presidents of the new organization, directors, and members of its executive committee. Of twenty-one directors elected, eleven represent General Motors interests. Necessary changes in listings of companies affected by the merger have been approved by the Stock Exchange.

At a recent election of officers of Eastern Air Transport, North American Aviation's operating subsidiary, E. R. Breech was made chairman of the board. With the exception of the resignation of vice-president Thomas A. Morgan to become president of the Sperry Corporation and of John Sanderson, formerly secretary and treasurer, to take that position with Sperry, there are no changes in the list of officers headed by Thomas B. Doe, president. L. Edwin Gill and Charles H. Dolan, who formerly were director of public relations and operations manager respectively, have been made vice-presidents. The office of the president and general traffic headquarters of Eastern Air are being moved from the Sperry Building in Brooklyn to the General Motors Building in New York, while the other executive offices are being transferred to Atlanta, Ga.

Corporation developments

With special intention to supply the Latin American market with light airplanes the Lanphier Aircraft Corporation has been organized. The new company, whose offices are at 50 Broadway in New York, is headed by Maj. Thomas G. Lanphier. Vice-president is S. Niedleman; secretary-treasurer, J. G. Rolthman.

Longren Aircraft Inc. has announced the receipt of an order from the Army Air Corps for one fuselage, to be sent to Wright Field at Dayton for extensive static testing by the Engineering division. Though the company has turned out a complete airplane, its major interest is in the construction of bodies and fuselages.

Scintilla A. G. of Solothurn, Switzerland, largest and best known makers of electrical automotive equipment abroad, have just acquired world rights (exclusive of the U. S. A.) to all Hurley-Townsend patents and manufacturing processes. In the near future Scintilla-Hurley-Townsend spark plugs will be available at Scintilla branches throughout the world. The American market will continue to be supplied by Hurley-Townsend Corporation of New York.

Personnel

Rear Admiral Ernest J. King, selected to succeed the late Rear Admiral William A. Moffett as Chief of the Bureau of Aeronautics, assumed his duties on May 3. Qualified as a naval aviator in 1927, Admiral King has had 960 hours in the air. He has commanded the Aircraft Squadrons of the Scouting Force, the Naval Air Station at Hampton Roads, the aircraft carrier Lexington, and served as Assistant Chief of the Bureau under Admiral Moffett in 1928 and 1929. Previous to his association with aeronautics Admiral King

was outstanding in submarine work, notably as director of the salvage operations of the Submarines S-51 and S-4.

Also detailed to the Bureau of Aeronautics are Lt. Comdr. Theodore C. Lonnquest, at present in command of VS Squadron 2B of the USS Saratoga and Lt. Comdr. Francis M. Maile of the Naval Aircraft Factory, Navy Yard, Philadelphia.

Comdr. George D. Murray, Assistant Naval Attache at the American Embassy in London, has been ordered to the U.S.S. Saratoga as head of the Air Department.

Maj. Thomas De W. Milling, one of the pioneers in aviation who learned to fly under the Wrights, has retired from the Army on account of ill health after 22 years of military flying. He established several early world records, one a flight of an hour and 58 minutes with two passengers, and commanded air service units abroad during the War.

William E. Brechtold has resigned as member of the staff of the Aeronautical Chamber of Commerce. Manager of its Air Transport and Airport Sections, Mr. Berchtold also edited the Aircraft Year Books for the four years during which he was connected with the Chamber.

At the recent annual meeting of the Aviation Corporation W. N. Beal, president of Auburn Automobile Company, was elected a director to succeed Amon C. Carter, resigned. Other members of the Board, of which E. L. Cord is chairman, remain unchanged.

L. B. Manning, chairman of the board of American Airways and president of Aviation Corporation, has been made a director of Pan American Airways.

Barney Graves, formerly in charge of ground transportation for American Airways, has been charged with general supervision of all service to passengers, mail and express throughout the line's entire coast-to-coast system.

Herbert J. Thomas was recently elected chairman of the Society of British Aircraft Constructors, succeeding Sir John Siddeley who has been its chairman for the past two years. A pilot in 1910, he has been associated with the Bristol Aeroplane Company since that time in many capacities, from that of pilot to assistant managing director.

Lt. Comdr. P. V. H. Weems, navigation expert and originator of the Weems System of navigation, after his retirement from the U. S. Navy this month will be connected with the Ryan School of Aeronautics at San Diego, Cal.

W. S. Peper, who was vice-chairman of aeronautic activities for the Society of Automotive Engineers during the past year, has been elected chairman of its Metropolitan Section. Mr. Peper, previously connected with Curtiss-Wright and Bellanca, now maintains consulting offices of his own.

SIDE SLIPS

By Robert R. Osborn

THE following communication is from Mr. S.P.J. of New York: "In looking over some aircraft specifications in Jane's 'All the World's Aircraft' the other day I ran across something that might suggest some attention in Side Slips. I noted that the international marking printed on the side of the Dornier Super Wal was startlingly labeled "I-RIDE." This led to a little research which disclosed several other interesting combinations. For example, on page 5C is a Belgian monoplane labeled O-BABI. A copy of the International Register of Aircraft offered the following possibilities: I-DEAR; F-AIKE; I-AAKE; I-DUCE (of Italy, no less!); F-AILU; OK-ALL; G-AAWD."

We are glad that Mr. S.P.J. called this to our attention, as we have intended suggesting the advantages of this lettering system to our Department of Commerce, in preference to the present numbering system applied to American aircraft. The lettering system has so much greater possibilities for identifying types of ships or their owners. For instance, the G.B. racer, which holds the landplane speed record, would undoubtedly be assigned the letters G-WHIZ,—and a light plane struggling

along cross-county against a stiff wind, would have the appropriate designation O-SHUX. For identifying personalities, we could use S-0000 on the airplane flown by Ed Wynn, the Texaco Fire Chief of radio fame. Rudy Vallee would have H-IHO we suppose, and President Roosevelt's new amphibion would undoubtedly be designated NU-DEAL.

We see by the papers that Pan-American Airways claims to have had some unusual cargoes, in addition to human beings and mail, in the last few years. They claim 253,425 monkey-miles in one year, 916 flamingo-miles and 41,683,000 insect-miles. The last statistic makes us a bit dubious about the whole claim—in that insects are supposed to be very prolific in family matters. If they had claimed a certain number of rabbit-miles, for instance, we could have been sure they were guessing. Incidentally, no matter what other claims are made, we think we know the pilot who has the greatest number of tree-miles,—as we think he has the *only* tree-miles, in an airplane. It was around 1926 or 1927 when we saw this remarkable flight. Airplanes weren't kept in very good condition in those days, and one could frequently find moss growing on control

surfaces, and blades of grass and birds' nests in engine cowling,—but when an old Curtiss Sea Gull flying boat went by us with a full grown palmetto tree rising out of the right cockpit, we thought matters had been allowed to go a bit too far.

In a contemporary aeronautical magazine we find a description of a new airplane which amuses us a bit. The article says nothing about the performance or general characteristics of the ship but says "The Air Ministry of Great Britain has recently added to its Air Force a new type of three-seat reconnaissance biplane, fitted with a special flotation gear that makes it practically unsinkable.—In one of the tests the airplane was set down in a fairly rough sea and was first struck by a naval pinnance which somewhat damaged the tail unit of the fuselage. A few minutes later a huge warship ran it down, completely submerging it, but the "unsinkable" bobbed up again a few seconds later and continued to float."

For some reason this reminds us of a cartoon we saw once, picturing a street faker selling pocket combs. He was sawing one of the combs on the edge of his basket and calling to the passersby, —"Hereyah! Hereyah! You can hit them with a hammer. You can drop them out of the tenth story window. You can run over them with a truck. You can use them to pry open windows but you can't ever break the teeth out of them." A prospective customer inquired, "How are they for combing your hair, Brother?" to which the salesman replied, "Oh, they're all right for that too."

FLYING EQUIPMENT

Stearman Sport Model 80

ON PAGE 457 of the November, 1932, issue of AVIATION there appeared a preliminary description of a sport type biplane by Stearman Aircraft of Wichita. Although the basic design was standardized the machine was to be built to order, details of equipment and accessories to be supplied in accordance with the desires of the purchaser. Recently the first Model 80 has been completed and turned over to John L. Vette, Jr., of Oak Park, Ill., for business and sport use.

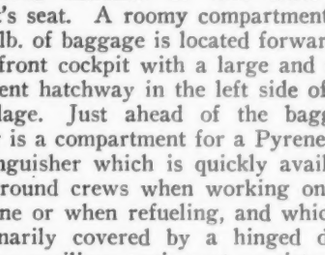
Department of Commerce A.T.C. No. 504 has been issued for the Model 80 as a two-place open land biplane with a 420-hp. Pratt & Whitney Model T3A Wasp Junior. A Hamilton standard controllable pitch propeller of the latest type is fitted. A full N.A.C.A. cowl encloses the engine.

The landing gear is of particular interest. It differs from the design originally announced in that it is wire braced fore and aft. The axle struts extend upward into the under part of the fuselage at the center line, and the shock-struts are placed almost vertically, the lower ends attached to the axles just inboard of the wheels, and the upper ends carried by short horizontal members cantilevered out from the lower longerons. All members are well faired in streamline housings. The points of intersection are usually well filleted, especially at the wheels where the coverings are bell-mouthed to enclose the brake mechanism. General streamline tires have been fitted. The tail wheel is of the full swiveling type, similar in principle to that of the Stearman 4CM1 described on page 696 of AVIATION, September, 1932. A metal housing over the wheel and fork carries the lines of the fuselage smoothly into the rudder.

Aerodynamically the ship shows few novelties. The arrangement of the wing cellule and control surfaces is conventional. Fore and aft trim is obtained by stabilizer adjustment in the usual manner, but a trailing edge flap on the rudder is used to compensate for slip-stream torque instead of the more common asymetrical fin. The flap portion of the rudder is not hinged nor can it be adjusted in the air. It consists of a sheet metal insert in the lower part of the rudder trailing edge which can be bent or twisted to provide the required compensation.

Two tandem cockpits are provided with dual controls. The front windshield is demountable and a cover is provided for the cockpit opening to convert the machine into a single seater of somewhat higher performance. The rear cockpit is completely enclosed by a transparent covering of the now familiar racing pattern which slides easily backward over the headrest to permit unhindered entrance or exit from the pilot's seat. A roomy compartment for 100 lb. of baggage is located forward of the front cockpit with a large and convenient hatchway in the left side of the fuselage. Just ahead of the baggage door is a compartment for a Pyrene fire extinguisher which is quickly available to ground crews when working on the engine or when refueling, and which is ordinarily covered by a hinged door. Other auxiliary equipment consists of a Lear radio receiver and also an inter-cockpit radio phone communication system. The instrument equipment is usually complete including a Sperry directional gyro and horizon. Three electrically operated flares are installed behind the pilot's cockpit, and built-in or retracting landing lights are furnished. The general specifications of the airplane as given by the manufacturer are: span, 35 ft.; length overall, 25 ft. 1 in.; height overall, 9 ft. 8 in.; wing area, 275 sq.ft.; weight empty, 2,380 lb.; useful load, 1,120 lb.; gross weight, 3,500 lb.; wing-loading, 12.72 lb. per sq.ft.; power loading, 8.33 lb. per hp.; max. speed (sea level), 175 m.p.h. at 2,250 r.p.m.; cruising speed (88.5 per cent max, r.p.m.), 151 m.p.h.; normal range at cruising speed (104 gal. gasoline), 650 miles.

Stearman Model 80 for Mr. John L. Vette.



Detail of wire-braced landing gear of Stearman Model 80.

Lockheed's Electra

THE word Lockheed conjures up pictures of sleek monoplanes streaking bullet-like through space,—a Wilkins thundering across polar skies, a "Winnie Mae" high over Siberian steppes, an Earhart bridging the stormy North Atlantic, and swift transports roaring up the Alleghanies or down the California Coast on daily schedules. From the first Vega to the last Orion, however, Lockheed ships have had two important features in common. Changes and improvements in detail have been many, but basically since 1926 the core of Lockheed philosophy has been a single engine in a highly streamlined wooden monocoque body.

With the announcement of the new Electra (which recalls another feature which all models have in common,—names derived from stars or constellations), it is obvious that basic changes are under way. Certain lines in the new ship bear the unmistakable Lockheed imprint, but the single power plant has been abandoned in favor of two engines. and metal replaces wood as the primary structural material. (Vega, Orion and Altair models of present construction will be continued).

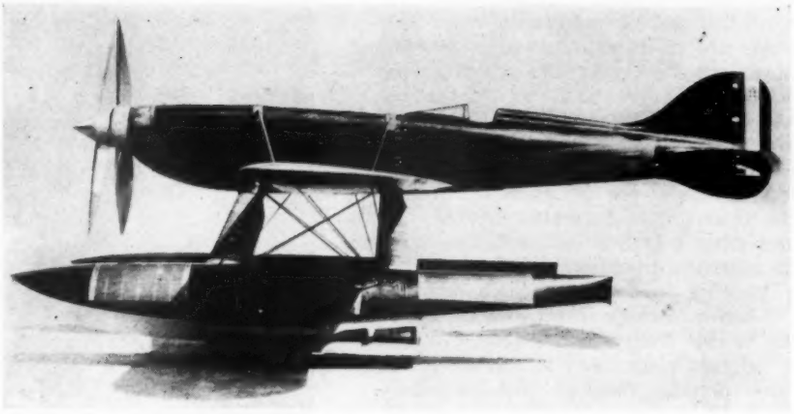
The Electra is to be a low-wing two-engined transport built for the requirements of the 1933 market. Seating is planned for two pilots forward and ten passengers in the cabin amidships. The

requirements for the comfort of passengers have been carefully studied in the seating arrangement and in insulation, heating and ventilation of the cabin. As usual, lavatory facilities are provided at the rear of the cabin. The baggage space totals 68 cu.ft., 40 cu.ft. in the nose ahead of the cockpit, and the balance divided between two compartments of 14 cu.ft. each in the wing stub.

The pilot's compartment will be fitted with the conventional wheel-type control and complete instrument layout, including Sperry horizon and directional gyro. Provision has been made in the design for the installation of complete two-way Western Electric radio, and all electrical wiring in the ship, both for radio and lighting circuits will be installed in metal conduits with metal junction boxes located at convenient points.

The infolding retracting landing gear of the Orion (see AVIATION, February, 1933) has been abandoned, and on the new ship the wheels will fold upward and backward into the underpart of the engine nacelles. In the retracted position each wheel lies wholly within the nacelle boundary. Regular electric and emergency manual controls for the wheels are to be provided. Indicators and warning devices will be installed. The retracting system will also permit a fore and aft adjustment of the wheels when in the extended position to take care of variable load conditions. When the airplane is lightly loaded (no passengers in the cabin) the wheels may be extended slightly forward from the normal position to facilitate handling on the ground. Goodyear airwheels and Goodyear hydraulic brakes will be standard equipment.

All structural parts are made of 24 ST and 24 ST Alclad is used for the skin. The fuselage is a semi-monocoque, and the wings are of a semi-stressed skin type. The most notable feature of the wing is the use of a single spar. As indicated in the three-view sketch, a single deep girder member passes from tip to tip at the point of greatest wing-section thickness. This member takes care of all bending and the shear and torsional stresses are transmitted to it through secondary rib members and through the skin itself. The main wing panels are detachable from the stub at the nacelles to facilitate inspection and maintenance. The deep girder spar through the wing stub distributes the stresses from the engine mounts and also absorbs the landing loads.

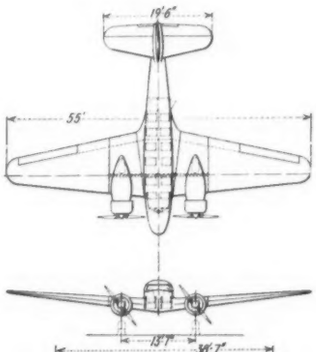


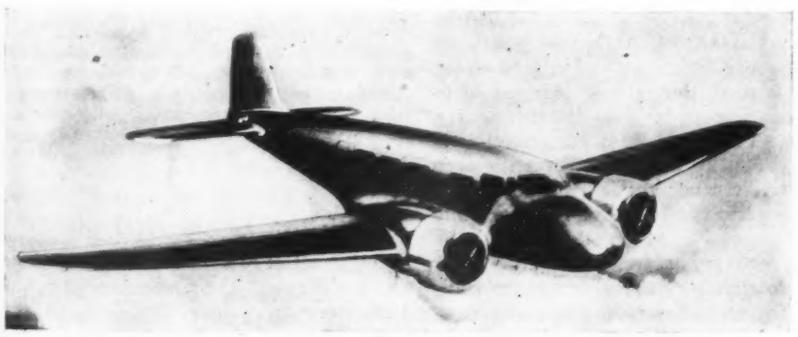
The Macchi-72 which holds the world's speed record.

Two fuel tanks of 100 gal. capacity each are located in the entering edge of the wing stub, between the engine and the fuselage. In accordance with the latest practice the nacelles extend well forward in the leading edge and in line with it. The plane of the propellers is well ahead of the pilot's position in the cockpit.

As of other ships of unusually clean line, some form of lift increasing device is desirable to reduce gliding speed and to permit steep gliding angles. For this purpose split trailing edge flaps (with conventional ailerons) are being used in the Electra, by which it is calculated the gliding angle may be reduced from approximately 14 : 1 to about 8 : 1. Horizontal and directional balance, as in practically all of the current transport designs, will be obtained by the use of adjustable trimming flaps in the trailing edge of the rudder and elevators.

The first of the Electras is now under construction at the Lockheed plant at Burbank, Cal. The machine will be powered by two Pratt & Whitney Wasp Juniors, rated at 420 hp. at 2,200 r.p.m. and supercharged to maintain full power at 5,000 ft. The general specifications as furnished by the manufacturer are: span 55 ft.; length overall 38 ft. 7 in.; wing area 458 sq.ft.; weight empty 5,655 lb.; useful load 3,345 lb.; gross weight 9,000 lb.; maximum speed at sea level 215 miles an hour; cruising speed 180 miles an hour at 1,975 r.p.m.





Preview of Lockheed's Electra in flight and three-view drawing.

Italy's record holder

ITALY'S long and tragic efforts which since 1928 have cost her literally millions of dollars and the lives of five of her best pilots, have finally culminated in a new world's record for maximum speed. On April 10, 1933, Sergeant-Major Francesco Agello, 31-year old sole survivor of Italy's Schneider cup race team of 1929, pushed the record from the 406.99 m.p.h. of Stainforth's S6B Supermarine to 423.79 miles per hour on a Macchi-72 seaplane.

In general the Macchi-72 follows the pattern which was established by the racing designers of 1926. It is a low-wing monoplane, mounted on twin floats. The wing structure is of all duralumin and the fuselage is composite, being of all metal for the for-

ward half and all wood in the rear. The floats are of duralumin and wood, the upper surfaces being almost completely covered by the radiators for the oil and cooling water. Additional radiators are mounted on the underpart of the fuselage toward the tail. The outstanding feature of the design is the use of the twin propellers mounted co-axially and close together in tandem rotating in opposite directions.

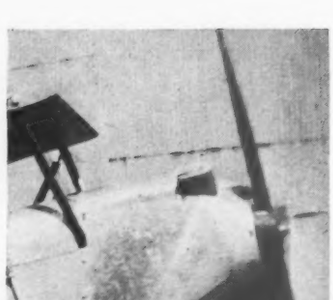
The Fiat AS.6 engine which occupies the entire fuselage forward of the cockpit is in reality two twelve-cylinder V engines placed end to end, each engine driving one of the propellers through concentric shafting. The engine was exhibited at the Paris Salon and described in some detail in AVIATION, January, 1933. The use of the two propellers is said to improve the stability of the airplane and to assist greatly at take-off. As might be expected the twist of the slip stream from the forward propeller is counteracted by the action of the rear propeller so that the flow of air over the fuselage and control surfaces is straight rather than helical. The action of the control surfaces is improved, and the cockpit is unusually free of engine exhaust gases. In many racing types the slip stream tends to whip engine gases into the cockpit, the consequent physiological reaction on the pilot making the flying doubly hazardous.

Although the two units of the AS.6 engines are mechanically separate, they are both fed from a common induction system. The fuel supply is from one large carburetor of eight barrels, supercharged from a rotary blower driven by the rear power unit. The output of the engine is 2,900 hp. at 3,000 r.p.m. with an engine weight of 2,130 lb.

Steam takes to the air

UNLESS one is prepared to admit that Sir Hiram Maxim's gigantic steam-driven box-kite actually rose from its circular steel rail track in the year 1894, the successful flight of William J. Besler from the Municipal Airport at Oakland, Cal., on April 12, 1933, marks the birth of the steam-powered airplane. Apart from Maxim's abortive efforts, other nineteenth century experimenters, among them Langley, Stringfellow and Henson, had succeeded in launching steam-driven models, but the work of the brothers Besler is certainly the first to be successful at full scale. Some work on steam units of high power is under way at Great Lakes Aircraft Corporation but so far no actual flights have been reported.

That the engine successfully test-flown in a biplane originally powered by an OX-5, was designed for, and is now being installed in, a 20-ton switching engine for shunting Pullman cars in a railroad yard sounds like an item from Ripley's "Believe-It-Or-Not" column. For this reason the stresses in the bearings, connecting rods and cylinders are more nearly comparable to locomotive practice rather than to ordinary airplane work. No serious attempt has been made in the first engine to cut down weight, but it is obvious that a re-design of the power-plant using alloy steels stressed to the normal aircraft range would make possible a tremendous saving. The two-cylinder compound double-acting V-type engine weighs approximately 180 lb. by itself. The boiler and auxiliary equipment, including water, fuel oil, etc., weigh 485 lb. The bore of the high-pressure cylinder is 3 in. and that of the low-pressure 5¼ in. The stroke is 3 in. With a boiler pressure of 1,200 lb. per sq.in. the output is approximately 150 hp. at 1,625 r.p.m.



Nose of the Besler brothers' steam-powered biplane which formerly housed an OX-5. The steam engine which successfully flew the craft was designed for a 20-ton railroad switching apparatus.

The engine was mounted in the nose of the airplane in the usual position direct connected to a two-bladed propeller. Immediately behind was the boiler plant. The primary element of the steam generator is a single water tube approximately 500 ft. long, built around an automatically controlled crude oil burner which is designed to release as much as 3,000,000 B.t.u. per cu.ft. of fire-box per hour. A steam feed-water pump is used, the exhaust being used to preheat feed-water as it enters the boiler. The total water consumption is about 1,500 lb. per hour, but with even a relatively crude condensing system (a small section of ordinary automobile radiator was used in this case) the water recovery is approximately 99 per cent, so that 10 gal. of water are sufficient for an ordinary flight under relatively cool temperature conditions. In the experimental machine the water capacity was approximately equal to the fuel capacity.

To start the boiler it is only necessary to throw a switch which starts an electric blower forcing air and fuel through the burner into the boiler where the mixture is ignited by a spark. From then on the automatic control takes charge, and the pilot has only to operate the throttle and reversing lever.

One of the advantages of an external combustion engine is the fact that it may be reversed. Those who remember the work done by the Army Air Corps in 1919-20 with reversible pitch propellers, can visualize the effects produced on landing runs by actual reversal of rotation of the engine. Experiments have indicated that the propeller reversal may be carried out in the air just before landing to build up a negative thrust and thus to increase the gliding angle. It has been reported that approach angles as steep as 5 to 1 have been accomplished with the Besler airplane, and that the actual landing run on the ground can be held to under 100 ft.

The steam engine in the air is said to be much quieter than any of the usual types. Propeller noises and the screaming of wires were still present, but the roaring of the open exhaust was entirely eliminated. Observers reported that the pilot had no difficulty in making his voice heard by members of the ground crew as he flew low over the field.

The Besler brothers are now turning their attention to the railroad and bus field, but are planning to resume their aeronautical research when general business conditions permit.

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With foreign builders

IT HAS BEEN customary to supplement our accounts of new American airplanes and engines with descriptions of interesting European designs as the details become available, a practice which will be continued. Through the foreign press, and extensive private correspondence, however, a constant stream of information comes to us on which space limitations make full coverage impractical. For the benefit of those who do not have any opportunity to read the European publications regularly we shall henceforth include in these columns a résumé of the interesting new designs. Both military and commercial types will be covered, and so far as possible machines will be grouped in accordance with their special functions. The descriptions will necessarily be brief, but they may serve to indicate the general trend of design abroad.

New British commercial planes

THE BRITISH have been quite prolific with their commercial model announcements since the first of the year. Among the first to appear was

the deHavilland Dragon, characterized as "an airliner in miniature." It is intended for feeder or taxi work, or for the private owner who employs a professional pilot. It is a biplane powered with two 130 hp. Gipsy engines, mounted outboard from the fuselage in the lower wing panel in well-streamlined nacelles. Although intended primarily for civil use, the Air Ministry has been experimenting with the Dragon for colonial military work. Airspeed, Ltd. has produced a high-speed low-wing monoplane of the cabin type, for general cruising purposes, notable because it is the first British airplane to make use of a fully-retracting landing gear. Basically the machine is a straight-forward, low-wing cantilever monoplane of clean lines, powered with a 240 hp. Armstrong Siddley Lynx engine. The first of these machines is to be used by Sir Allen Cobham in an attempt to fly from England to Australia without intermediate landings by refuling in the air. Another monoplane in quite a different category is the newly-tested Miles Hawk, a light two-place open cockpit machine powered with a Cirrus engine. The machine is of the low-wing type, and is built entirely of wood.

Boulton and Paul mail carrier

ONE of the most important additions to the list of British civil aircraft is the Boulton and Paul mail carrier. It is a high-speed airplane, designed to meet the specifications laid down by the Air Ministry early in 1931, for a two-place all-metal landplane with one or more engines with a mail capacity of 1,000 lb. and a range of 1,000 miles, and a cruising speed of at least 150 miles an hour. The machine is a biplane of equal span and equal chord with slight stagger. The fuselage is narrow and is deep enough to completely fill the gap. The two 550 hp. Bristol Pegasus engines are mounted in nacelles attached to the underpart of the upper wing. The propellers are thus sufficiently high up so that with the machine standing on the ground they may be run without danger of striking personnel working around the ship, an important feature for a cargo carrier. The undercarriage has an unusually wide tread. The wheels are non-retracting, but are well faired into large streamlined housings attached to the under-surface of the lower wing immediately below the engine nacelles. The ship is fitted with automatic slots on the upper wing, and all flying control surfaces except the ailerons are rigged with servo flaps. The machine has been designed to give the specified speed with engine throttled to about 50 per cent of total output. A speed of 85 miles an hour can be maintained at 4,000 ft. with but one engine running. All structural parts are of steel and the coverings of fabric.

ERGEBNISSE DER AERODYNAMISCHEN VERSUCHSANSTALT ZU GÖTTINGEN; *Vol. 4; edited by Dr. L. Prandtl and Dr. A. Betz; Berlin; 1932; 148 pages; $3.20 approximately.*

THIS fourth volume of aerodynamic reports from the famous Göttingen Institute includes, like all its predecessors, a wide variety of theoretical and experimental material. Some 90 new airfoil sections have been tested. So have rotating cylinders; multiple venturi tubes; wings with all sorts of cutouts in their plan form, and low-wing monoplanes with a standard wing attached to fuselages of varying cross-sectional forms. In none of these fields, however, does the research appear to have covered the ground so systematically or so exhaustively as is now the common rule with the studies of the N.A.C.A. The most notable of the volume's additions to those theoretical studies which have made the Göttingen staff, and particularly Dr. Prandtl, world-famous is a paper by Dr. Prandtl himself on the turbulent motion of fluids through tubes and along the surface of plates.

DEATH IN THE AIR, *by a Royal Flying Corps pilot; William Heinemann Ltd.; London, 1933; 166 pages; $2.40 approximately.*

AS A STORY, this is unimportant. As a photograph album, it is at once technically remarkable and the focus of an exciting controversy that shows no sign of coming to an end, for this is the book that contains the famous Cockburn-Lange photographs of air fighting. Received calmly enough when they were first printed in an American magazine several years ago, their publication in England has aroused a great flurry of charge and countercharge. C. G. Grey, of *The Aeroplane,* leans strongly to the belief that the pictures are fakes. Various fighting pilots of long experience have expressed themselves as sure of it, and their accusations are supported by a wealth of technical evidence.

Fakes or no fakes, they are wonderful pictures, and it is almost as hard to conceive of the means by which they might have been faked as to conceive of their having been taken during actual air combat. Fakes or no fakes, there are plenty of wartime pilots to testify that these 47 exposures give some splendidly accurate pictures of what death in the air looked like to the men who faced it. As to the text accompanying them, that, as already suggested, is negligible. Compared with "War Birds," for example, there was very little life in it to begin with and most of what there was has been annihilated by excluding every mention of a particular place, operation, or unit, and every clue by which an individual or a squadron could be identified. The exaggerated caution shown in that respect lends a good deal of support to the charge that the whole thing is a gigantic, a wonderfully skillful, and an almost inexplicable hoax.

FLYING, *by Gen. James E. Fechet; William & Wilkins Company; Baltimore; 1933; 138 pages; $1.*

A GENERAL SKETCH of aeronautics for the interested outsider, half its length devoted to history and the other half to the training of pilots, the design and construction of airplanes and engines, and the various services which aircaft perform. To those who are already in the aeronautical field the book has little or nothing to offer, but presumably it was not written for them. For those without special aeronautical experience who would like to know what aviation is all about and where we are going, the volume will provide an hour's very interesting reading.

THE BLUE BOOK OF AVIATION, *edited by Roland W. Hoagland; Hoagland Company; Los Angeles, 1932; 292 pages.*

IT IS NO easy matter to prepare an adequate and complete Who's Who in a field with such a rapid turnover of personnel as aviation has shown. This is the latest attempt of the kind. Though an interesting effort, it is a highly unsatisfactory one.

The heart of the book is of course the collection of biographical sketches, some 900 in number. Unfortunately, as in many previous attempts of the same sort, the selection of the subjects was bad. What is to be said of an aeronautical Who's Who which includes numbers of ex-aviators whose only aeronautical connection was to have been officers in the Army air service during the War, and sundry young ladies whose only claim to fame is the possession of

a private pilot's license, yet makes no mention of the president of United Air Lines, of the president of Trans-Continental & Western Air, of the chief engineer of the Douglas Company, of the president of the Pratt & Whitney Aircraft Corporation, of the general manager of Eastern Air Transport, or of the president of American Airways? There are many other omissions equally conspicuous. The crowning aggravation is that the biographies are thrown into the book completely at random, and it is necessary to refer to a separate index to locate a name and page reference.

Nevertheless, in the absence of anything better, the Blue Book will be a frequently used work of reference. The biographies are very usefully supplemented by a chronological index of important events in aeronautics, with references to the published biographies of those responsible, and not so usefully by a miscellany of historical and pictorial material.

WHO'S WHO IN BRITISH AVIATION, 1933; *edited by T. Stanhope Sprigg; Airways Publications, Ltd.; London, 1933. 225 pages; $1.75 (approximately).*

THOUGH much less ambitious than the volume just listed, and having no such decorative form as characterizes the Blue Book, this is a much more successful attempt at a biographical directory of the aeronautical world. The subjects appear to have been selected with great care to include everyone who is prominent in any phase of British aviation. The names total some 1,100. For each one, there is a simple and standardized tabulation of biographical data with no attempt to write a narrative of the subject's life. The volume is really indispensable for anyone who has or expects to have any contacts with British flying.

L'ANNÉE AÉRONAUTIQUE, 1932; *edited by L. Hirshchauer and Charles Dollfus; Dunod; Paris, 1932; 354 pages; $2.50 (approximately).*

THIS is the thirteenth volume of L'Année Aéronautique. Like its twelve predecessors, it contains illustrations and descriptions of new planes and engines, extensive reports of record-breaking flights and notable cross-country trips, a directory of the French aeronautical industry, and individual statistical reports on the activities of all the air lines in the world. The section that used to be devoted to the organization of military aviation in the various countries is now omitted.

Like its twelve predecessors, the volume is remarkably complete and remarkably accurate. Like them, also, it is exceptionally free from national prejudice, for though it is frankly intended principally for circulation in France it includes a reasonably adequate report of the flights made and the competitions held in other parts of the world. Of the 30 great flights of the year selected to be mapped in detail, for example seven are American. The representation of American airplanes in the listing of new designs, however, is exceedingly meager. Only the Lockheed Orion and the Gee Bee racer find place there, along with some 30 machines of European nationality.

THE AIR ANNUAL OF THE BRITISH EMPIRE, 1932-1933; *edited by Squadron-Leader C. G. Burge; Gale & Polden, Ltd.; London, 1932; 530 pages; $6 approximately.* Unlike the annual previously listed, this one makes no pretense of being international. It is a book about the British Empire, but there is enough similarity between the problems of the British Empire and those of the rest of the world so that many of the articles are almost universally applicable. What such authorities as Oliver Stewart, C. C. Turner, and G. P. Bulman have to say about the development of aircraft and engines will be read with interest and respect under all flags, as will an analysis and comparison, by H. A. Mettam, of the various performance formulas that have been developed (including those developed by the editor of AVIATION, and printed from time to time in its pages). On the whole, however, technical articles play a smaller part in the Annual than in past years, and it has become more frankly than ever before a narrative of the British accomplishments of the year and a directory of the British aircraft industry. All the types of aircraft now being produced by British manufacturers are separately described, in considerable detail and with generous illustration. A handsomely-printed and a well-edited book, this volume of the Annual will be most useful as a collective catalog of British aeronautical products.

THE FAIREY III.S. AIRPLANE WITH NAPIER LION ENGINE; *H. M. Stationery Office; London; 1932; 82 pages and many folded plates; 75 cents approximately.* A detailed description and rigging and maintenance manual on the standard type of British observation plane for aircraft carrier service. It is exceptionally complete and of more than average interest, for comparative purposes, to American designers.

HORIZONS, *by Norman Bel Geddes; Little, Brown & Company, Boston; 1932; 293 pages; $4.75.* Mr. Geddes, well-known theatrical and industrial designer, has let his imagination roam over the future of architecture and mechanism. The story of its roamings is told in "Horizons" in some 220 plates, including 30-odd on purely aeronautical subjects, and accompanying text. His plans for the future are extraordinarily interesting and ingenious, and they are drawn to a scale of almost fantastic magnificence. The Geddes terminal airport is to provide for the storage of 184 planes of 110-ft. span, and for a considerable number of larger size as well. Eleven loading platforms are approached by underground passages, and arrivals and departures at intervals of one minute or less are foreseen as the normal order of the day. Still more impressive is the proposal for a rotary floating airport, 1,500 ft. x 750 ft., to be placed in New York Harbor just south of the Battery and outside the ship channels.

But the airport proposals are modesty itself compared with the airplane which Mr. Bel Geddes has designed in cooperation with the German engineer Koller. It is a tailless twin-hulled monoplane flying boat, carrying 451 passengers and a crew of 155. The span is to be 528 ft., the gross weight 1,275,000 lb., the horsepower 38,000, the speed range from 72 to 150 m.p.h. The estimated cruising radius is 7,500 miles, the estimated cost $9,000,000. "Ain't that sump'n'?"

Mr. Bel Geddes is passionately addicted to streamlining for everything, and his designs for motor buses and railroad trains will be of marked aeronautical interest, and perhaps more immediately realizable than his airplane. A very suggestive, and in spots an exceedingly amusing, book.

HISTOIRE DE L'AÉRONAUTIQUE, *by Charles Dollfus and Henri Bouché; L'Illustration, Paris, 1932; 572 pages 16 x 24 in.; $10 approximately.* Whatever else this book may do, you may be sure of two things. It will bring a glitter to the eye of any book-lover who sees it, and it will make any publisher groan at the thought of the production costs involved. It is a simply incredible volume, with hundreds and hundreds of pictures and literally dozens of full-page plates beautifully reproduced in color. The first picture in the book is of an Egyptian bronze of Isis, the winged goddess. One of the last shows Amelia Earhart getting down from her plane in Londonderry after her transatlantic flight. It would scarcely be an exaggeration to say that there is a picture of everything that had happened in between. Not only the great flights, but also the technical novelties, are included, with pictures or aerodynamic laboratories, of various systems of metallic construction, of modern engines and superchargers, and so on, world without end. Though the text is subordinate to the pictures in appeal, it is well arranged and forms a very valuable review of the history of the art. Even for one who cannot read a word of French, however, the pictures alone would make the book well worth while.

AIRCRAFT AT WORK

Seeding California's rice fields by air

BECAUSE its germination must take place under water, rice does not lend itself readily to methods used in seeding other crops. The ordinary procedure is to scatter the seed on dry ground by means of tractor- or team-hauled spreaders (at the rate of about 25 acres a day), then flooding the seeded area. Even when manipulated most carefully, the inflow of the water washes away the seeds in some places and covers them too deeply with mud in others, and unfortunately, once the ground is flooded it is impossible to resow with ground equipment. The ideal method is first to flood the field and then, after permitting the shallow water to be thoroughly warmed by the sun for two or three days, to scatter the seed directly in the water. Rice sown by this method begins to grow nearly two weeks earlier than seed planted in the old way, yields a thicker and more uniform stand of rice, and because the seeds of grasses and weeds do not germinate under water the rice crop is unusually clean.

The adoption of airplane sowing by California rice growers not only meets ideal planting conditions but also increases greatly the acreage which may be planted in a given time. Where a suitable landing field can be found close to the work, it is quite possible to plant approximately 400 acres in a six-hour flying day. The cost is low (approximately 50 cents per acre where the grower furnishes and delivers the seed to the landing field). There is also considerable saving in seed cost, for due to the greater efficiency of planting better crops result from the use of 100 to 125 lb. of seed per acre than was formerly obtained with the 130 to 160 lb. per acre average.

The Nicholson Commercial Flying Service, under the direction of Mr. Ray Nicholson, has been doing a great deal of the rice sowing work in the Sacramento valley, where, during the last six years, about 55 per cent of the total rice acreage has been sown from the air. Ordinary open cockpit biplanes of about 200 hp. are used for the work. A hopper containing 600 lb. of seed is installed in the forward cockpit, discharging through the floor of the machine to a chute and a trap door operated by the pilot. A calibrating valve governs the rate of flow of the seed, which averages somewhere in the neighborhood of 100 lb. per minute. A certain amount of scattering is done by the slip stream, but for uniformity, a plough-shaped spreader is attached behind the trap door. It has been found that the maximum width of strips sown, consistent with uniform distribution of the seed, results from flying about 35 ft. off the ground. From this height the seeded strip is about 35 ft. wide. Two flagmen on the ground, one on either end of the field to be sown, give the pilot his line of flight so that overlapping of strips is held at a minimum.

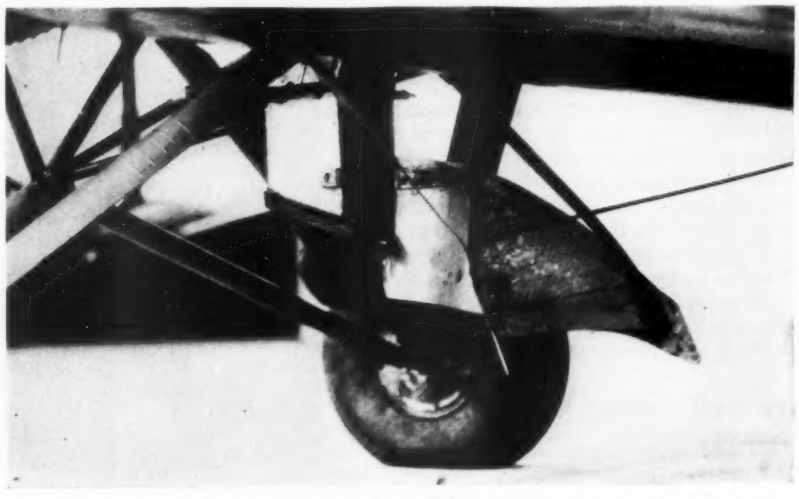
The Marines have landed . . .

BUT this time on the mosquito. Marine Corps pilots operating out of Quantico, in co-operation with the United States Public Health Service, have evolved new means of mosquito control in malaria-infested swamps. Embattled mosquito hordes have discovered that the man-made flying "insects" not only hum more loudly, but also pack a sting more potent than their own. The method employed is to spray swampy lands with a dry paris green mixture from an altitude of about 100 ft. The poison will float on the surface of the water for about two hours, during which period the larvæ of the mosquito must come up to the surface at least once for air and food. It has been found that three dustings a few hours apart will clean up an infested area, but the process must be repeated at intervals of about two weeks to insure permanent elimination of the pests.

Vanishing cow pony

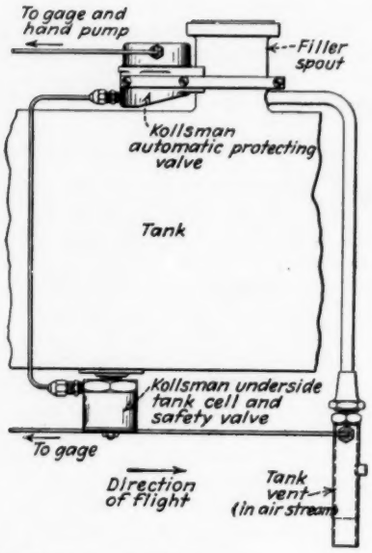
OUT where the west begins, where men are men and all that sort of thing, and where ranch acreage sometimes runs close to the 100,000 mark, the processes of evolution grind slowly on. Reports coming in from certain sections of Nebraska indicate that it is only a question of time until airplanes displace the cow pony and picturesque rodeos turn into flying meets. Famous among the flying ranchmen of that region, Tom Arnold makes constant use of his four-passenger monoplane to maintain contact between his headquarters in South Dakota and extensive lease holdings in Nebraska.

Men, mail and supplies are quickly transported to outlying localities which can be reached only by many hours of difficult surface travel. Veteran cow ponies round out their days in peaceful grazing, while the airplane roars out over hundreds of miles of prairie to round up storm-scattered herds of cattle. Ancient buckboards rot slowly away in ranch yards as time-pressed buyers of beef-on-the-hoof from Omaha and Chicago stockyards inspect potential purchases from the air. More than once human lives have been saved when accident victims in outlying ranches have been flown to city hospitals. Some of the high-flying ranchers have also realized a cash return on their investments, for when ships are not out on the range or "riding fences" they can be used to give air-minded neighbors a little flying experience—at a price.



Discharge valve and spreader attached to under part of a rice sowing airplane.

THE BUYERS' LOG BOOK



Kollsman fuel gage

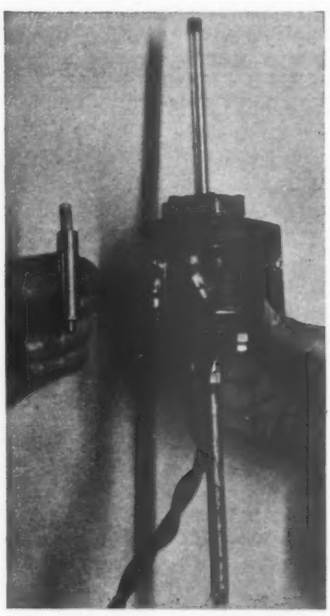
KOLLSMAN Instrument Company, Inc., makers of sensitive altimeters, now widely used in transport and service airplanes, have lately developed a fuel gaging system which eliminates many of the difficulties encountered in the installation and use of the ordinary hydrostatic type. In place of the usual hydrostatic cell installed in the fuel tank from the top, the Kollsman system substitutes an underside tank cell and safety valve and an automatic protecting valve at the top of the tank to prevent fuel entering the lines to the gage on the instrument board. This is important, because gages are sometimes damaged by fuel entering the lines, or by excessive tank pressure due to filling from high pressure pumps. The underside tank cell is entirely external to the tank itself. It is unnecessary to exercise any great care or accuracy in installing it (at any exact level in the tank, for example) and it is universally adaptable regardless of tank size, shape or volume. In the event that the connecting line is broken or removed for any reason, no gasoline can escape, since a valve automatically closes until the fuel system is again air-tight. A special vent maintains the pressure in the instrument case and on top of the fuel in the tank at same value. In the Kollsman system a fuel quantity gage and gage pump are installed in the instrument board in the usual manner. The connections for the gage and pump are shown in the accompanying sketch.—AVIATION, *June, 1933.*

Aircraft towing signs

WITH the increasing popularity of aerial advertising by means of large signs towed behind aircraft (see AVIATION, December, 1932, page 493), Air Transport Equipment, Inc., Garden City, L. I., N. Y., has developed and placed on the market a complete line of signs for towing purposes. They may be towed behind autogiros, small airships, or any average airplane. The signs are of a new type which permit the quick changing of letters.—AVIATION, *June, 1933.*

Fuel safety valves

A DEVICE which automatically shuts off the flow of gasoline to the carburetor when the ignition switch is turned off has been developed for aircraft use by Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. The primary purpose is to eliminate fires from broken fuel lines. The valve which was developed by Mr. L. G. Riley, a Westinghouse engineer, consists of an inner steel core and an outer hollow tube which becomes an integral part of the gasoline line. When the ignition switch of the airplane is turned to the "on" position, current flows through a coil of wire wound around the outer tubing and exerts a magnetic pull upon the inner core piece and holds it open against spring pressure. When the ignition is cut the flow of current ceases and the spring forces the core piece closed, thus sealing off the fuel line. A new type of flanged, flared-tube joint eliminates leakage. The valve has no stuffing boxes to pack and no gaskets to remove, and is said to remain leak-proof throughout its entire life. Valves can be arranged to operate on any voltage from 12 to 500 and are available in three sizes to handle liquids or gases in pipe lines ranging from $\frac{1}{8}$ to $\frac{13}{16}$ in. in diameter. The smallest size weighs $3\frac{3}{4}$ lb. complete and the largest 16 lb.—AVIATION, *June, 1933.*



Westinghouse fuel valve.

Fairchild five-lens camera

COINCIDENT with a report that the Institute of Geographical Exploration of Harvard University had completed a photographic record of the entire State of Massachusetts came the announcement of a special five-lens aerial camera by Fairchild Aerial Camera Corporation used for the survey. The Model T3A aerial camera is in reality five cameras combined into one. The central camera takes a vertical photograph, the other four chambers take obliques. Each camera is equipped with a film magazine with a capacity of about 200 exposures, and the film in all five cameras is advanced simultaneously by a turn of a crank. The shutters of all five lenses are also tripped simultaneously by a single lever. After development the negatives from the central camera are contact printed, and those from the oblique cameras are rectified and brought to the same scale by means of a Model B-7 transforming printer which is a part of the camera ground equipment. The five prints are then trimmed accurately and assembled in the form of a Maltese cross. The new camera covers many times more area in a single exposure than the single lens type, and therefore materially reduces the time required to survey a given area. The width of strip covered by the T3A camera is about 1 mile for every 1,000 ft. of flying altitude. From 14,800 ft. one photograph covers 126 square miles. —AVIATION, *June, 1933.*

Fairchild five-lens camera